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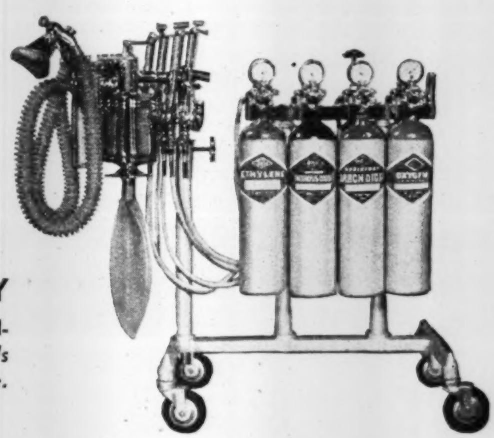

The Bulletin of the National Association of Nurse Anesthetists

VOLUME 7, NO. 2 MAY, 1939

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ALICE MAGAW

Anesthetist to Drs. William J. and Charles H. Mayo

1892-1908

THE FIRST NURSE ANESTHETIST

Miss Alice MaGaw was born in Ohio, November 9, 1860. Her family moved to Michigan and later to Minnesota. In 1887 she entered the Woman's Hospital School of Nursing in Chicago, from which she was graduated in 1889. In 1892 she was employed as anesthetist to Drs. William J. and Charles H. Mayo, which position she held until 1908. She was married to Dr. George Kessel in 1908 and died in February, 1928. The following was the first paper published by a nurse anesthetist.

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(December, 1906, Volume 3, pages 795-799)

A REVIEW OF OVER FOURTEEN THOUSAND SURGICAL ANAESTHESIAS

Alice MaGaw, Rochester, Minnesota
Anaesthetist to St. Mary's Hospital

Since the discovery of ether in 1846 by William Morton, much has been written about anaesthetics and their administration, and still ether and better etherization is more in favor today than ever before.

We are indebted to Dr. Bevan and Dr. Mellish for their most excellent articles on this important subject, on the after-effects as well as the administration of anaesthetics.

At St. Mary's Hospital our preference has always been ether. In 1905, out of 3,080 anaesthesias 2,847 were ether. In 14,380 anaesthetics given by me, I have yet to see a death directly from the anaesthetic, but, no doubt, have had my share of trouble in its administration, although artificial respiration with us is almost unheard of. Our experience with ether has become more gratifying each year. In my series of cases, the "open method" has been the method of choice. We have tried almost all methods advocated that seemed at all reasonable, such as nitrous oxide gas, as a preliminary to ether (this method was used in 1,000 cases), a mixture of scopolamine and morphine as a preliminary to ether in 73 cases, also chloroform and ether, and have found them to be very unsatisfactory, if not harmful, and have returned to ether "drop method" each time, which method we have used for over ten years.

On account of this method not being followed properly, it is not always appreciated. We use a four-ounce ether-can and fit an ordinary cork with a groove on either side into its mouth, fill one groove with absorbent cotton and let it extend out of the can about one inch. One can regulate the drop easily by the manner in which the point is clipped. We usually fix two cans, one with a large dropper, and use it until the patient is fully under the anaesthetic, and then change to the other can with the small dropper, and continue its use during the operation.

Patients usually walk into the operating-room and mount the table with assistance. All foreign bodies, such as artificial teeth, chewing gum, etc., are removed. The hands are fastened loosely across the chest with a wide gauze bandage, to prevent the arms falling over the sharp edges of the table, an

accident which so often causes musculospiral paralysis. A pad of moistened cotton is placed over the eyes to protect them from the anaesthetic. If, during the course of administration, some of the anaesthetic should fall into the eye, drop a few drops of castor-oil into the conjunctival sac, to prevent the conjunctivitis that would otherwise follow.

It is a mistake to think that the same elevation of the head will do for all patients. The anaesthetist should elevate the chin to such a position as not to bend the neck too far back or approximate the jaw too near the sternum. Proper elevation of the head will relax all tissues of the neck and give more freedom in breathing. This, also, can be said of the jaw. Holding the jaw up and forward, and keeping it in position so that the patient gets the greatest amount of air possible, is an important feature in giving an anaesthetic. While too much emphasis cannot be laid on this necessary requisite in giving an anaesthetic, all jaws cannot be handled in the same manner. When a patient has removed a double set of artificial teeth, the tongue will often cleave to the roof of the mouth during the administration, and raising the jaw sets the gums so firmly together that most of the air is shut out, and this may not be noticed until the patient is cyanotic. We have found, in this class of cases, that if the jaw is held but slightly up and forward and the thumb of the same hand inserted between the gums, thereby holding the tongue down, faulty respiration will be corrected at once and the color restored. This is one of the instances where the holding up of the jaw too firmly can be overdone.

The inhaler used is the improved Esmarch, with two thicknesses of stockinet (frame boiled and stockinet changed after each patient). We use the dropper described, dropping as slowly and carefully in giving the ether as though it were chloroform, until the patient's face is flushed, and then a few layers of surgeon's gauze are added, and the ether given a trifle faster until the patient is surgically etherized; then return is made to the same covering as at the start, and the regular drop continued throughout the operation.

As it requires very little ether to keep a patient surgically etherized, one can change to the small dropper during the operation. A much deeper narcosis is required to start an operation or to make the incision than later on, when the operation is in progress. It is useless to touch the cornea, as so many advocate, as it tells us nothing and is unscientific. Only the inexperienced take the pulse and touch the conjunctiva when giving ether.

Suggestion is a great aid in producing a comfortable narcosis. The anaesthetist must be able to inspire confidence in the patient, and a great deal depends on the manner of approach. One must be quick to notice the temperament, and decide which mode of suggestion will be the most effective in the particular case: the abrupt, crude, and very firm, or the reasonable, sensible, and natural. The latter mode is far the best in the majority of cases. The subconscious or secondary self is particularly susceptible to suggestive influence; therefore, during the administration, the anaesthetist should make those suggestions that will be most pleasing to this particular subject. Patients should be prepared for each stage of the anaesthesia with an explanation of just how the anaesthetic is expected to affect him; "talk him to sleep," with the addition of as little ether as possible. We have one rule: patients are not allowed to talk, as by talking or counting patients are more apt to become

noisy and boisterous. Never bid a patient to "breathe deep," for in so doing a feeling of suffocation is sure to follow, and the patient is also apt to struggle.

In gall-bladder work, nearness to the diaphragm causes an irregular respiration, and this is sometimes mistaken for a call for more anaesthetic, when more often it is just the reverse. If the patient is surgically anaesthetized, the irregular breathing and grunting does not interfere with the surgeon. Instead of drowning the patient with the anaesthetic, remove the mask at this stage and allow him plenty of air, and he will not become cyanotic. This is also true of operations on the sphincter muscles. Any manipulation will be followed by the same symptoms. Respiration is often interfered with in this class of cases. Obstruction is caused by the tongue falling back and depressing the epiglottis. Should any of these symptoms arise during the administration, raise the jaw up and forward, and instead of using tongue-forceps, catch the tongue with a piece of gauze and draw it up and toward the nose, a little to one side, withdrawing the anaesthetic. Should mucus become troublesome, one can easily wipe it out with an extra piece of gauze prepared for that purpose.

The dose required for each individual patient cannot be estimated so as to be of any value, as it depends largely on the temperament of the patient, pathological condition present, time consumed in anaesthetizing, and operating. The only one that can judge is the educated anaesthetist, who will give only what is needed to do good work. From experience we know a patient can be brought under ether in from three to five minutes, and, when ready, patients do better if the operation is started at once. Often the anaesthetist is blamed for not having some positive sign of complete narcosis. We have never found a single positive sign upon which we could rely. If the surgeon and anaesthetist are accustomed to each other, the surgeon seldom asks if the patient is ready. He knows from the deep respiration, color, and relaxation. Failures are in the acute peritonitis cases and in alcoholics. There are many signs that guide, such as deep respiration, relaxed jaw, as well as relaxed muscles; yet these signs sometimes fail. If the patient is kept in an even surgical anaesthesia, there is not enough change in the patient to warrant all the useless fussiness we sometimes see on the part of the anaesthetist. I rely a great deal on the relaxation of the jaw, both before and during operation. When the Trendelenburg position is necessary, it means trouble for the surgeon, and simply delays all work, to start the operation before complete relaxation.

During the operation, as soon as the patient begins to get control of the jaw, more complete narcosis is required. If the jaw is relaxed and in place, respiration deep and regular, color normal, quality of pulse good, there need be no fear about the rate of pulse or the pupils. Other points being equal, they are certain to be right.

As a rule, any person fit for a serious operation is also fit for an anaesthetic, but no one is so free from danger that care in watching its effects can be dispensed with. The cases requiring the greatest care are not the young and anaemic, for whom a small dose is sufficient, but the strong and vigorous, who inhale deeply and are inclined to struggle.

There is no class of cases that requires more close watching of every detail than the stomach cases, because they are poor subjects for anaesthesia of any kind, and the anaesthetist should be fa-

miliar with each step of the operation, so as not to give one drop more of the anaesthetic than is absolutely necessary. We give one sixth of a grain of morphine thirty minutes before the administration of ether, and the patient is given just enough to produce surgical anaesthesia, and as soon as the stomach is explored and the method of operation decided upon, the ether is withdrawn, the surgeon being able to continue operation, no more being given until time to close the incision.

In this class of cases the patients are allowed to become almost conscious many times, as the stomach is not sensitive, and there is no pain in the visceral work; thus we are able to complete the operation and avoid vomiting with an exceedingly small amount of anaesthetic.

The rolling of the eyeballs as noted by Simpson, swallowing, and control of the jaw are signs of returning consciousness, and a call for more ether. While we give less anaesthetic in this class of cases than in any other, it is this class that is most prone to pneumonia.

During the thirteen years' work at St. Mary's Hospital all patients have been anaesthetized on the operating-table in the operating-room, and preparation of the patient was going on at the same time. Experience has taught us that preparation of the patient while going under the anaesthetic is one of the important factors in producing a rapid surgical narcosis; for it diverts his attention, and much less anaesthetic is required. It matters not in what position the patient must be for operation, we fix him accordingly, and the preparation is begun at the same time as the anaesthetic, and we feel certain that this procedure enables us to hasten narcosis.

In the Trendelenburg position, where the preparation is in progress during the administration of the anaesthetic, the deep respiration, etc., empties the pelvis, so that by the time the operation is started the small bowel will be found in the lower abdomen and out of the way, and may be packed off. We have found this practice more helpful to the surgeon than placing the patient in position after the completion of narcosis.

In giving an anaesthetic for this class of surgery, the skill and patience of the anaesthetist is tried to the extreme; the patient must be fully anaesthetized, but not too profoundly. Patients having an acute peritonitis, as is so often found in this class of cases, require a much larger amount of anaesthetic to produce relaxation of the abdominal muscles. When the patient is prepared during the administration of each anaesthetic, there is no time lost, the surgeon and his assistant being ready by the time the patient is surgically anaesthetized. Another important reason for anaesthetizing the patient on the operating-table is, that in lifting and shifting a patient about, he is apt to regain consciousness, with vomiting, etc., and the administrator is not positive of the condition of his patient. Should ether produce difficult breathing, profuse secretion of mucus, or cough, lift the mask from the face, allow a liberal amount of air, and then continue with the ether. In giving plenty of air when needed, and less anaesthetic, we have found little use for an oxygen-tank, a loaded hypodermic syringe, or tongue-forceps. It is far better for the anaesthetist to become skillful in watching for symptoms and preventing them, than to become so proficient in the use of the three articles mentioned. We are exceedingly careful in our selection of cases with colds. An acute cold is a contraindication to any anaesthetic, but

as soon as the cold becomes chronic there is not much danger from etherization, and instead of operating during an acute cold and giving chloroform (unless in an emergency), we wait a few days until the acute attack has passed, and then they are as good subjects for ether as for any other anaesthetic. Chronic bronchitis is often improved by an anaesthetic.

Pulmonary tubercular cases stand ether well. It has been proven that pneumonias follow a local anaesthesia as well as a general, so the trouble is not wholly from the anaesthetic. We often have a lung oedema present during the administration of an anaesthetic, and for several hours after an operation, that is often mistaken for ether pneumonia, but the oedema will clear up about the time an ether pneumonia should begin.

There is also an embolic and septic pneumonia that occurs independently of the anaesthetic and is due to an infection, and will sometimes occur with or without a general anaesthetic.

The dangers of general anaesthesia depend more on the lack of experience and incompetency of the anaesthetist than on the drug itself, in most instances. Many operations do not demand the long anaesthesia of ether, with its discomforts, neither do they warrant the dangers of chloroform anaesthesia. In this class of operations we have been using primary anaesthesia, and find it preferable to nitrous oxide gas, chloroform, or ethyl bromide.

Formerly, operations for exophthalmic goiter were looked upon with a great deal of dread, on account of the anaesthetic. We have found these cases, when properly managed, and the ether given by the "drop method," were as good subjects for anaesthesia as any other class of cases of the same gravity. We also give these cases 1/6 of a grain of morphine and 1/120 of a grain of atropine, the latter to avoid tracheal mucus, thirty minutes before operation, and find it very helpful in tiding the patient along with but a small amount of anaesthetic.

The method of giving chloroform is quite like that of ether; yet there are marked differences to observe. Chloroform should be given with more air and in less quantity, with the regular and small drop. Chloroform acts quickly, and should be given slowly and carefully, the pulse being taken at the facial or temporal arteries. Anaesthetists should never allow either the patient or themselves to feel hurried. Stop inhalation as soon as patient has reached surgical anaesthesia, giving just what is needed, and not one drop more. When struggling occurs, withdraw the chloroform entirely until the patient is quiet, as struggling will produce deep inhalation; hence the danger. Embarrassment in respiration during the administration of chloroform should always be considered serious, and it requires prompt attention and an immediate withdrawal of the drug.

The pulse often misleads the novice. It may be very weak just before vomiting, when one might think there was less need of anaesthetic, while really it is a call for more. A thready, intermittent pulse indicates trouble. As Dr. Finney says: "It is well to watch the character and rate of pulse, but of far more importance to watch the respiration as the earliest indication of danger." The eyes may give warning of danger. A rapidly dilating and fixed pupil is a danger signal, while a pupil contracted to a normal size or a little less indicates surgical anaesthesia. The color of the blood is also important. Watch all symptoms, but do not rely on any one of them. When giving chloroform to children, I never feel safe if

the child is profoundly under, and I try to avoid this condition, aiming to keep it as nearly as possible in moderate anaesthesia. An unsatisfactory pulse or respiration is a call for plenty of air. By doing this there will be little need of the numerous drugs so often resorted to.

Nearly all fatalities on the operating-table due to an anaesthetic are from chloroform, either mixed with some anaesthetic or given unadulterated. Public opinion is so much in favor of ether at the present day, that if accidents in its use occur, the surgeon will not be blamed, and it is to his interest, as well as to that of his patient, to see to it that his anaesthetist becomes proficient in the administration of all anaesthetics, especially ether.

While surgeons know that a competent anaesthetist is one of the most important factors in the operating-room for his own comfort, as well as for that of his patient, there is no class of work that has so little encouragement, and few are willing to follow this line of work (that, in difficulty and nerve-strain, is next to that of a surgeon) long enough to become familiar with the first requirements of a good anaesthetizer.

To give an anaesthetic properly is all one person can do, and he who undertakes to learn surgery at the same time makes a serious mistake. It has been my privilege to instruct several in the administration of anaesthetics, and I must say that nurses become the most proficient in this line of work. They do not aspire to be either a surgeon or an assistant surgeon; hence it is not difficult for them to give their undivided attention to the anaesthetic. I am sure the time is not far distant when nurses will be looked upon as best fitted for the administration of anaesthetics.

One derives little or no benefit from textbooks. While one should be competent in the theoretical part of this important work, there is nothing so helpful to the anaesthetist as the hard school of practical experience.

THE ART OF ANESTHESIA, ESPECIALLY AS APPLIED TO ABDOMINAL SURGERY*

R. L. SANDERS, M.D.

Memphis, Tenn.

To have lived means to have suffered. Pain has been an unhappy experience in the life of every human being since the beginning of time. Your presence here today represents a challenge to the monster, Pain, and a rebellion against its ravages. Means to dispel this destroyer of tranquillity and comfort have been sought throughout the ages, yet it marches on, conquered only by the use of anesthetic drugs. Sir William Osler once said, "Anesthesia is the greatest single gift ever made to suffering humanity; at a single stroke the curse of Eve was removed." No wonder the world bows in homage to those benefactors who developed anesthesia!

The beginning of the use of anesthetics is not known. Narcotics have been

* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

referred to since antiquity. Homer in his Odyssey says, "Helen dropped into the wine of which the soldiers drank a drug, an antidote of grief and pain, inducing oblivion to all ills. He who drinks of this mingled cup sheds not a tear the livelong day, were death to seize his venerated sire or her who gave him birth, or were the sword buried in the bosom of his brother or greatly loved sister, no tear would even then bedew his cheeks."

More than 2000 years ago, the vapor of hemp was used to induce intoxication, and the juice of certain leaves was taken to relieve the pain of cutting or burning the human flesh. Early in the Christian era Galen speaks of the use of mandragora to paralyze sensation and motion. The search for a safe means to triumph over pain has never ceased, and today we are reaping the rewards of this search. To call a partial roll of the inhalation anesthetics which have been discovered, and their discoverers, one would mention Priestley's discovery of nitrous oxide in 1772: Long, ether in 1842, and Morton's public demonstration of it in surgery in 1846; Simpson, chloroform in 1847; ethyl chloride, discovered in 1847 but not used until 1900; ethylene, in 1923; and cyclopropane, introduced by Waters and his associates in 1934. In addition, other methods of inducing anesthesia have been devised, chief among them, perhaps, being intraspinal and intravenous injection.

In slightly less than a century, literally millions of anesthetics have been given and a vast amount of information has been added to our knowledge of anesthesia. The art of anesthesia has come to be based upon certain fundamental laws. The anesthetist who would excel in this art and promote its advancement must seek to understand these laws and learn to apply them in practice. According to Flagg, the *controlling element* of these laws constitutes the real essence of the art. He further states that experience begets dexterity, tact and skill. But he admonishes that familiarity breeds contempt. The anesthetist must never forget to approach each case with *courtesy* and *respect*, for the possibilities of failure as well as of success in each are almost unlimited. A thousand anesthesias, instead of leading to crudeness, should make one a thousand times more careful.

The majority of authors of books and monographs on anesthesia have been graduates in medicine. They emphasize the great need for physicians who are especially trained to administer anesthetics. They state that the anesthetist should study the patient before and treat him after the anesthetic. Such an Utopian ideal would be excellent if it were practicable, but in the average case it is utterly impossible. Admittedly, such special procedures as intratracheal, intravenous, and spinal anesthesia should be administered by expert physician anesthetists; the usual inhalation anesthetic as given in the vast majority of cases, however, can be administered by the nurse anesthetist in a most satisfactory manner. In the city of Memphis, practically all inhalation anesthetics are given by forty-five nurse anesthetists; so far as I know, there is not a single physician anesthetist who devotes all or even a part of his time to anesthesia. Here in the South, the use of physician anesthetists would not be economically feasible. Our Southern people are not financially able to pay the fees which would be necessary to support a sufficient number of physician anesthetists in our hospitals to take care of the work. Nurse anesthetists have less invested in education and usually have few family re-

sponsibilities, and can therefore afford to work for less income. From the standpoint of efficiency, moreover, they are well suited for the position. They are interested in their work; they concentrate their attention upon the administration of the anesthetic and are not diverted by an interest in the technique of the surgical procedure. They have keen powers of observation, are sensitive to the patient's reactions and quick to recognize impending danger, and they feel their reliance upon the surgeon sufficiently to call his attention to the first indication of trouble. Further, their concern about the patient goes beyond the operation. They have both the time and inclination to follow his immediate postoperative course and to do whatever may be necessary to make him comfortable and reduce postoperative complications.

Not only this, but the services of nurse anesthetists are always available. They can be relied upon to answer calls at a moment's notice. Their time is not divided between the giving of anesthetics and the practice of medicine. They take up their work as a life's profession and, as a consequence they can continue their association with the surgeon indefinitely—an advantage to both surgeon and patient, since they soon learn the surgeon's habits of procedure and can interpret and carry out his needs without direction.

The same attributes which make women peculiarly adapted to the profession of nursing fit them particularly for work as anesthetists. Because of their intuition and innate sympathy, they are gentle, alert, careful, and faithful in the performance of their duties, and are thus able to carry to a high perfection the art of anesthesia.

All anesthesia is of three types: spinal, general, and local anesthesia. Since my interest is largely in abdominal surgery, I shall limit my discussion to spinal and general anesthesia. Local anesthesia, obviously, has only a restricted application in this branch of surgery.

Spinal Anesthesia. In the early days spinal anesthesia fell into disrepute because of the many complications and the number of fatalities which attended its use. The anesthetic agent had not been developed to its present perfection, and there were other considerations, such as lack of experience in administration of the drug, which added to its unsavory reputation. Now, however, in competent hands spinal anesthesia may be employed with safety and a certain degree of satisfaction. From the surgeon's viewpoint, spinal anesthesia is highly desirable in that, by its use, ample relaxation is obtained, the operation is expedited, and trauma to the viscera is minimized. In many cases it seems that the patient is more comfortable after operation and results are better. However, unless given by an expert and unless the course of anesthesia is watched throughout by someone who is especially trained to discover any complication, spinal anesthesia still has its dangers.

A personal element enters into the question of whether one should or should not give a spinal anesthetic, and if the surgeon would not prefer to have it used in his own case, I think he should probably avoid its use in his practice, so far as possible. One surgeon has stated that members of his staff and their families have preferred spinal anesthesia for themselves. Many of us, on the other hand, feel differently about the matter. I have frequently stated that I should not like to have a spinal anesthetic myself, and I hesitate, therefore, to give it to a patient unless it is definitely indicated and inhalation anesthesia would be unsatis-

factory or inadequate. It has been my observation that the complications from spinal anesthesia equal those from general anesthesia, and for this reason I find no definite argument in favor of the former as a routine measure.

Further, one should not overlook the psychic element which must be reckoned with in the use of spinal anesthesia. I have seen a number of patients who held bitter memories of the operating room scene. The fact that their lower extremities were paralyzed, that they experienced that unusual numb feeling which is characteristic of the anesthetic, and were awake and conscious of the procedure, made an impression on their minds which was decidedly unfavorable. Other patients, however, have not objected to the experience. There is a wide difference in the reaction of patients, and one should therefore select with care those who are to receive a spinal anesthetic. As a rule, inhalation anesthesia produces no unfavorable psychic reaction.

General Anesthesia. — For many years, or to be exact, from the time of its discovery until 1923, ether was the most popular of the anesthetic agents. Its power of relaxation has never been surpassed by that of any other inhalation drug. Its toxic effect upon the liver and kidneys, its irritative action upon the respiratory tract, and the postoperative discomfort of the patient are distinct disadvantages. Although an inestimable boon to humanity, superior in many respects to previously known anesthetics, ether leaves much to be desired.

Nitrous oxide has always held a definite place in abdominal surgery. The oxygen content of this gas, however, is approximately only 10 per cent, and the risk of asphyxia and anoxemia which it involves is an element of some concern. Further, its inability to induce profound narcosis and adequate relaxation necessitates its use with some other drug, usually ether. When an abdominal operation is to be performed, complete anesthesia and muscular relaxation are desirable. If nitrous oxide and oxygen only are used, without a special indication, the patient can be kept on the table, but the surgeon is materially handicapped in the performance of the procedure. If ether is used freely, however, the potency of gas-oxygen is enhanced. Gas-oxygen induction and ether maintenance, followed by gas-oxygen for recovery is ideal in many cases. By this method, the ether given during the maintenance period may be entirely eliminated by the gas-oxygen during the stage of recovery.

Ethylene, which was introduced in 1923, is similar in effect to nitrous oxide, though is much more powerful and provides a more profound anesthesia and far better relaxation. With this drug, one may reduce the amount of supplementary ether, and in some operations upon the lower abdomen dispense with it altogether. Ethylene is non-irritating to the respiratory tract, as is nitrous oxide, but is superior to nitrous oxide in that its higher ratio of oxygen tends to prevent venous hemorrhage and cyanosis. Postoperative nausea and vomiting and distention are rather more severe than following the administration of nitrous oxide, but less so than following ether. Ethylene, therefore, represented a long step forward in the history of anesthesia, and in fact was the universal preference among anesthetic agents until within recent years.

The success of ethylene stimulated a wide interest in the possibilities of anesthetic drugs and inspired numerous investigations. Surgeons became more exacting in their demands for an an-

esthetic which would be safe for the patient and reduce to a minimum postoperative complications, yet insure freedom of surgical performance. A drug which almost ideally meets these demands was found in cyclopropane.

The principal advantages of cyclopropane lie in its high oxygen content (85 per cent), and the fact that it is the least toxic of the inhalation anesthetics. For these reasons, cyclopropane may be given with safety for all types of operations and to patients who present the most serious surgical risks. Induction is smooth and without effort, and breathing is quiet and unlabored throughout the course of anesthesia. This feature is particularly desirable in patients with heart disease, since the heart is thus spared the strain incident to difficult respiration. In like manner, protection is afforded patients with pulmonary complications; the air passages are not irritated, there is little secretion of mucus, and the cough reflex is preserved. Cyclopropane is also suitable for the diabetic; the conversion of glycogen in the liver is not increased, nor is the kidney excretion of sugar, acetone, or diacetic acid impaired. In the anemic and debilitated, cyclopropane may be administered without fear of exaggerating these states. Patients recover from the anesthetic quickly, and postoperative nausea and vomiting and distention are not troublesome. In fact, patients who have had operations wherein other anesthetics were used almost invariably express a preference for cyclopropane, because of the more pleasant induction and the greater postoperative comfort.

Muscular relaxation and ease of manipulation afforded by cyclopropane are, as a rule, equal to that provided by ether. When necessary, a small amount of ether may be added to the cyclopropane, depending upon the same factors which control anesthesia with other gases. When, as occasionally happens in operations upon the upper abdomen, slight difficulty is experienced in obtaining perfect relaxation by this method, we have found that muscle tension is effectually released by a regional block with novocain.

In a paper written jointly by Miss Fink and myself, our first 100 cases were reported. A few of the patients in that series suffered a moderate degree of shock, but there were no deaths attributable to the anesthetic. Later, I reported 250 cases, wherein even fewer patients gave evidence of shock. In more than 1200 operations performed under cyclopropane anesthesia since that report, not one patient has suffered severe shock or other untoward reaction, nor has any patient succumbed from the anesthetic. With this added experience, we have acquired a firm confidence in the safety of the drug.

We have recently combined helium with the gas-oxygen anesthetic for patients with asthma and heart disorders. Helium serves to dilute the oxygen, permitting its more thorough dissemination throughout the lungs. Being an inert gas, helium has no effect upon the vital organs.

Within the past few years much has been written regarding intratracheal anesthesia. Practically all our anesthetics have been given by the inhalation method and my experience with intratracheal induction is therefore limited. The method is valuable in upper abdominal operations on patients who are poor risks, since the intratracheal catheter keeps the airway unobstructed, obviating laryngeal spasm, and better relaxation is obtained.

A word should be said about the new anesthetic, pentothal sodium. This

drug, given intravenously, has proved a successful means of inducing anesthesia for short minor operations. Caraway, of Birmingham, has used pentothal in 3500 surgical procedures, many of them on the abdomen. The fact that the anesthesia is without postoperative effect makes this agent excellent for removal of drains following major abdominal surgery.

In all abdominal operations, the surgeon must have a safe anesthetic, a controllable anesthetic, and one which permits ample relaxation and is attended by the fewest possible postoperative complications. We prefer a well administered cyclopropane anesthetic with the occasional addition of a slight amount of ether and, if necessary, a supplementary abdominal field block. In rare cases, we find spinal anesthesia more suitable, but, other things being equal, cyclopropane serves our purposes most effectually.

THE PEDIATRIC CONSIDERATION OF ANESTHESIA*

EDWARD B. SHAW, M.D.

384 Post Street, San Francisco

There are three matters of especial interest to the pediatrician with respect to anesthesia: (1) preanesthetic medication, (2) the choice of anesthetic agents, and (3) the psychology of administration of an anesthetic. I can discuss these matters only from the standpoint of one who is interested in the child as a patient but who is without especial knowledge of the technique of either anesthesia or psychology.

Preanesthetic medication. Under ordinary conditions with proper handling of the patients most children do better without preanesthetic drugs. Only exceptionally is such medication necessitated because of pain and most of these drugs are designed to mitigate apprehension rather than pain. With children, fear is mostly the result of suggestion by parents, physicians, and nurses, and can ordinarily best be obviated by a reassuring gentleness and above all a steady matter-of-factness that reassures the child far better than narcotics or hypnotics. I especially would condemn the frequent use of morphine as a preanesthetic agent. Davidson, in "The Compleat Pediatrician," says that not in five years has morphine been used in one Children's Hospital, and I suspect he refers to his own institution. Morphine, in childhood, is the drug of the inept and the inexperienced. It is effective—too effective—and even in small doses adversely affects the safety of general anesthesia and favors the development of unpleasant respiratory complications. It is extremely difficult to predict the effects of morphine on the individual child and doses which seem perfectly proportioned to the size of the patient sometimes lead to serious depression of respiratory activity which may be apparent during operation, or immediately postoperatively with the development of varying degrees of atelectasis and a train of consequent complications. The purposes of drugs of this nature are much better served by codein, in which the latitude of safe ac-

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* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

tion is much greater than with morphine.

An occasional child, for causes which are largely environmental, may require sedation to control nervousness and favor smooth induction of anesthesia. Phenobarbital is well tolerated by children, as are some of the other barbiturates, and may suitably be used preoperatively or postoperatively.

One of the most useful drugs to produce marked sedation before anesthesia is paraldehyde given by mouth or, better, by rectum. This is well tolerated, extremely effective, and has wide latitude of safety.

Choice of anesthetic agents. There is a wide variety of anesthetic agents which is constantly being added to but, speaking purely as a pediatrician, I have yet to see any type of anesthesia better suited for routine use in childhood than a short induction with gas and oxygen followed by straight ether. Most of the advantages claimed for other types of anesthetics do not apply particularly in childhood. After several experiences with continued gas-oxygen anesthesia in young children which frightened me, I much prefer continued anesthesia with ether. The advantages which are claimed from time to time for chloroform, ethylene, ethyl chloride, cyclopropane, avertin, et cetera, find me still of the opinion that their advantages in childhood do not outweigh what we know of the safety of ether anesthesia. Children tolerate ether well; most of the advantages of other anesthetics particularly apply to adults while their dangers especially apply to childhood. Very young infants tolerate ether exceedingly well and I seldom hesitate to employ it. It seems to me especially illogical to be afraid to give an ether anesthetic at an early age and accordingly to proceed with an operation under local anesthesia. Small children and infants suffer far more from restraint, struggling, crying, exhaustion, and shock—the latter partly through overventilation—under local anesthesia than under an ether anesthetic.

Psychological considerations. The child enters the hospital to encounter a number of new and strange sensations. He meets a number of nurses, interns, and attendants and is confronted with a multitude of strange sights, sounds, and smells which excite an interest which may or may not be associated with fear. A previous operation may have taught him to associate these sensations with fear but usually it is the attitude of his parents and sometimes of hospital personnel which excites the emotion of fear. Children do not react even to pain with a cry of fear; a small child who bruises himself, is given an injection of diphtheria toxoid, or has some similar slightly painful experience may whimper with pain but will burst into a shriek of fear and rage when he sees an expression of great solicitude on the faces of his parents. It is only the superior parent who parts from his child at the operating room with a note of pleasant unconcern and unfortunately many children are torn from parents whose anguish leads the child confidently to expect the worst. A certain amount of fear is more or less inevitable and the worst way to meet this in the operating room is all too commonly employed—to over-reassure the child. In the operating room it is better for only one person to talk to the child rather than for all present to confuse him with various divergent distractions and playful protestations. The average child has a lively interest in proceedings and this interest need not be distracted from the matter at hand. The operating room contains a number of gadg-

ets which are interesting and not terrifying and a good many children will inspect the gas machine, play with the mask and note operating garbs with some interest. The noises should certainly be subdued; the glitter and clatter of instruments should be kept well in the background but nearly every child worth the effort knows that no picnic is in prospect and no effort should be made to convince him that it is.

The start of the anesthetic frequently sees the powerful emotion of fear augmented by the even more powerful one of anger as the result of restraint. A number of years ago the routine of many anesthetics which I saw was accomplished when, a fearful child having been wheeled into the operating room, everyone simply closed in upon him; his struggles were forcibly restrained by up to half a dozen adults, the mask was clamped on his face, and he was anesthetized fighting to his last conscious breath. These patients awaken with the fight still in progress and these anesthetics were succeeded by nightmares, tantrums, and a horror of hospitals which was anything but surprising.

Anger is a natural consequence of restraint and the child should be subjected to an absolute minimum of restraint while anesthesia is induced. Most children will be far less fearful and angry if they are permitted to sit up on the table while gas-oxygen induction is begun, most of them will hold the mask themselves and only a few will fight if the procedure is approached in a kindly but matter-of-fact manner. Many children need to be held in position but this need not be done in a way in the least resembling a straight jacket, and the result is a much simpler, smoother induction and operative course and an infinitely improved postoperative state.

I accompany most of the children whom I send to surgery even for minor operations because they know me and trust me. The child is given the gas mask, permitted to examine it, and usually holds it while the anesthetic is started, at first away from his face, and then he is gradually induced or helped to bring the mask closer to his face. A few breaths without struggle results in unconsciousness without struggle.

I make these remarks with the realization that some of you who know more about the subject than I do may disagree. I fear that I have brought little that is new to any of you and I can only state again that I have presented the view of a pediatrician and not of an anesthetist.

ANESTHESIA IN BRAIN SURGERY*

CHARLOTTE DUGGAR

University Hospitals of Cleveland

History

For the beginnings of cranial surgery we go back to a prehistoric age. No written records tell us of these first operations, but in our museums are preserved the skulls of Neolithic man that bear unmistakable signs of surgery.[1] Some of these specimens moved and had their being in the Stone Age; others were Gauls who lived some time

* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

before the dawn of Roman history. From the burial grounds of the Incas of Peru, a nation about whose early history nothing is known, and from caves and mounds in France most of these specimens have come. The operation carried out in that far distant age consisted of trephining or making a hole in the skull, and was probably performed in the treatment of headache, fits, insanity and fractures of the skull. The instrument by which those first trephine openings were made was a pointed stone—metal instruments came much later. The edge of the trephine opening in those skulls is rounded; this is proof that healing took place in the bone after the operation was performed. The operations, therefore, were carried out upon the living. The fortitude necessary to have a hole pounded through the skull with a pointed stone is left to the imagination.

First Removal of Brain Tumor

In spite of the vast amount of work that had been done in medicine throughout its entire history, all the theories that had been proposed by ancient physicians, and most of them in vain, all the observations, discussions and arguments, it was not until 1884 that the first tumor of the brain was removed from the living.[2] The operation was carried out by Sir Rickman Godles, and the operation stands as one of the greatest of surgical triumphs. The patient's ailment was properly diagnosed, the position of the tumor, furthermore, was accurately determined, and this of course was made possible by the experimental work on localization in the brain. The tumor was found lying beneath the surface of the brain and was entirely removed. The patient did well following the operation but sepsis developed and the patient died on the twenty-first day. This operation marks an epoch.

The era of operating on the brain opened with the beginning of the twentieth century, the foundation having been laid in the experimental discoveries of the preceding century—physiology of the nervous system and aseptic surgery. To these advances may be added also as a necessary prerequisite a new school of surgery founded in this country by William Stewart Halstead and applied in the case of the brain by his illustrious pupil, Harvey Cushing.

The first surgeon to take up the central nervous system as his sole field of endeavor was Harvey Cushing, and because of his skill, knowledge and untiring effort on the one hand and because of the opportunity offered by this relatively undeveloped field on the other, he deserves to be called the father of modern neurological surgery as it exists today. The progress in anesthesia has contributed to the success of neurological surgery performed today and has made possible many operations which could not otherwise have been performed.

Before discussing the subject of anesthesia perhaps it would be well to review the physiological facts which must be borne in mind when considering surgery of the cranium.

Accumulation within the cranial cavity of any substance (tumor, pus, cerebrospinal fluid, cysts, hemorrhage, et cetera) when present in small amounts may be compensated for by concomitant removal of cerebrospinal fluid by absorption or expulsion of blood from the capillaries and veins, without necessarily significantly increasing the intracranial pressure (the pressure of the cerebrospinal fluid). However, with further increase in the mass of the added substance, compensation by removal of cerebrospinal fluid and blood may become impossible, and since the

cranial cavity and meninges form a relatively inexpansible chamber, this increase in the total contents must result in a rapid rise in the intracranial pressure.

James B. Ayer[3] states that the normal human cerebrospinal fluid pressure is between 100 and 200 millimeters of water in the lying posture with the axis of the spine horizontal and the head in alignment; and that over 300 millimeters can always be explained on the basis of intracranial pathology. In the sitting posture the lumbar pressure is approximately doubled.

Under normal circumstances the intracranial pressure is always less than the intracapillary and intravenous pressure within the brain. If for any reason the intracranial pressure rises above the intravenous and intracapillary pressures these vessels will tend to be compressed, thereby diminishing the blood flow to the brain. This results in reflex vasoconstriction throughout the body, and an elevation in the arterial pressure, which when transmitted through to the capillaries and veins helps to maintain blood flow through these vessels, thereby compensating for the increased intracranial pressure. So long as this occurs, that is, so long as the arterial pressure is able to keep above the intracranial pressure, it is possible that sufficient blood flow through the intracranial tissues can be maintained to prevent their depression or damage.[4]

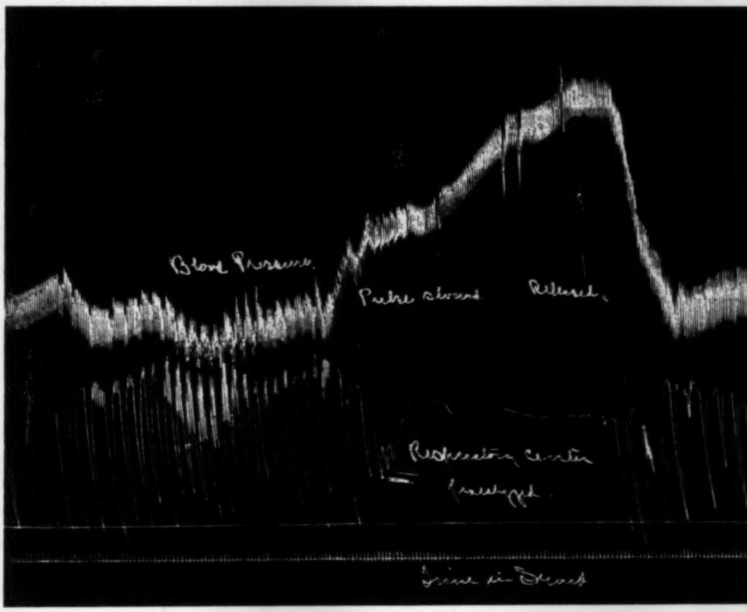

Fig. I

Graph showing increased intracranial pressure in a dog. Trephine opening of bone; saline solution injected under pressure. Graph shows blood pressure, pulse rate and respirations.

Usually an increase in intracranial pressure which is not compensated for

by an increase in arterial pressure results in failure of the respiratory center first, respirations becoming slower and finally changing into the typical gasping type of respirations of the terminal stage. With cessation of respiration there occurs rapidly a failure of the vasomotor center, with loss of vasoconstriction throughout the body, a fall in blood pressure and shortly thereafter a failure of the heart itself with complete cessation of the heart beat.

Experimentally Eyster[5] found that occasionally when the cerebrospinal pressure was elevated by the introduction of fluid into the cranial cavity, the blood pressure would periodically rise above and fall below the intracranial pressure. During the period of elevation of the blood pressure above the intracranial pressure the respirations would increase, and during the decline of blood pressure below the intracranial pressure the respirations would fail, thus producing a respiratory picture resembling Cheyne-Stokes respiration. In clinical cases the respiration may differ from the classical Cheyne-Stokes type in that the onsets of apneic and hyperpneic phases are abrupt and frequently are unequally spaced. Sometimes the breathing shows itself only by periodical recurrence of single breaths.

Therapeutically it becomes important to aid circulation to maintain a pressure above the intracranial pressure, and to make an effort to reduce the intracranial pressure back towards the normal volume. This latter can be accomplished by either needling the ventricular cavity, or by the introduction intravenously of hypertonic solutions.

So long as the cranial vault and dura are intact alterations in arterial or intracranial pressure cannot cause changes in the size of the brain. However, once the vault has been opened either venous obstruction or abnormal elevation of the arterial pressure may cause engorgement of the capillaries of the brain substance, thereby producing an actual increase in the mass of the brain tissues.

Anesthetists's Observations Preoperatively

The anesthetist should be thoroughly familiar with the patient's condition and symptoms before the anesthetic is started. The color, pulse, respiration and blood pressure should be recorded on the anesthetic chart. It is not always possible for the surgeon to measure the intracranial pressure preoperatively but headache accompanied by nausea, vomiting, visual disturbances, paralysis, personality changes, lethargy and unconsciousness are symptoms known as the classical symptoms of increased intracranial pressure. It is particularly important for the anesthetist to know whether or not the patient has a history of convulsions or epileptic seizures. Under light anesthesia these symptoms are more apt to recur, consequently a tongue depressor should be kept between the teeth at all times. If a convulsion occurs during the operation the anesthetist should note the part of the body involved and the anesthesia should be deepened if possible after the convulsion subsides.

Evaluation of Anesthetics

Local—Until the advent of the modern technique of general anesthesia local anesthesia was a protection to the patient during a brain operation and it is still of value today when the patient's condition will not withstand even a slight degree of increased depression. From the patient's standpoint local anesthesia is extremely undesirable because these operations are long, the position becomes fatiguing and unless the

patient is extremely lethargic it is impossible to prevent pain reflexes throughout the operation. If the patient becomes restless and mentally disturbed under local anesthesia, and particularly if there is coughing, nausea or vomiting, the intracranial pressure as a result may be greatly increased and the patient would have been protected by the early administration of a supplementary general anesthetic.

Ether—Ether is still a popular anesthetic in neurological surgery. The degree of increase in intracranial pressure with the resultant damage to the brain tissues depends upon several factors. Straining, struggling and coughing in the induction stage will cause a marked rise in intracranial pressure, and prolonged deep anesthesia will result in cerebral edema, particularly if associated with obstruction to respiration. If the patient can be anesthetized with a minimum of interference with respiration and circulation and if the patient is maintained in controlled, but not deep anesthesia the degree of damage is negligible. With free interchange and unobstructed breathing the blood pressure can be maintained at about its normal level or slightly below, which lessens the bleeding in the field of operation and makes the procedure correspondingly less difficult for the surgeon.

Nitrous Oxide—Nitrous oxide and oxygen does not produce a depth of narcosis suitable for neurological surgery, without the addition of heavy premedication which in many instances is contraindicated. The margin between controlled anesthesia, struggling on the one side and oxygen disturbances on the other, is so narrow that the slightest variation in the depth of anesthesia may cause a sudden elevation in intracranial pressure which may result in extreme cerebral congestion. Furthermore, it has been stated that the administration of oxygen with the nitrous oxide might, during certain phases of the operation, disguise the true condition of the patient. In our opinion, this cannot be accepted as a contraindication to the use of nitrous oxide in brain surgery, because logically we would be forced to apply this deduction to other types of surgery.

Ethylene and Cyclopropane — We have never considered the use of ethylene or cyclopropane on our neurological service because the Bovie unit is used routinely. Ethylene, however, would present difficulties similar to nitrous oxide.

Avertin—Within the past few years avertin has become very popular, and if a general anesthetic is indicated avertin supplemented with light ether anesthesia is, in our opinion, the anesthetic of choice. It gives excellent narcosis, there is no preliminary excitement stage and the amount of ether required to maintain controlled anesthesia is relatively small. The avertin dosage varies from 70 to 100 milligrams per kilogram of body weight and should be varied according to the condition of the patient and the degree of increased intracranial pressure present before operation. Gardner and Lamb[6] state that directly following the administration of 100 milligrams of avertin per kilogram of body weight there is an increase in the pressure of spinal fluid of approximately 100 millimeters of water and that after a lapse of fifteen to twenty-five minutes the pressure of the spinal fluid is approximately fifty millimeters higher than the initial reading. If the intracranial pressure previous to operation is greatly increased care should be exercised in the determination of dosage, because of the immediate increase in the intracranial pressure and the depression of the minute volume of

respiration that may result following the administration. Several years ago the depression of breathing following the administration of avertin was studied in our clinic and it was found that an 80 milligram dosage may reduce the minute volume as much as 40 per cent.[7]

Premedication—The usual premedicants such as morphine are contraindicated because of the depressing effect on respiration. Atropine is always administered.

Position of the Patient

Practically all intracranial operations are performed with the head at a higher level than the body, because this position tends to minimize bleeding. Three factors are to be considered in placing the patient on the operating table: first, the comfort of the patient; second, the avoidance of posture paralysis; and third, the interference with respiration from excessive flexion or extension of the head. Extreme flexion or extension of the head obstructs breathing and increases the intracranial pressure equally as much as sneezing, coughing, crying or emotional disturbances. It is also possible for the head rest to make pressure on the veins of the neck if not properly adjusted, which might interfere with the cerebral venous outflow.[8]

The Value of Hypertonic Solution

It has been confirmed repeatedly that the administration of strongly hypertonic solutions lowers cerebrospinal fluid pressure at least initially and these findings have led to the clinical application of this phenomenon.[9] Hypotonic solution, however, causes a prolonged rise. The continuous, slow, intravenous administration of glucose or acacia during the course of a prolonged intracranial procedure is also of benefit in preventing shock. If the blood pressure drops, citrated blood may be administered in a similar way. We routinely administer intravenously 50 per cent sucrose (150 to 300 cc.) or acacia throughout the operation. The total amount is governed by the condition of the patient. If the patient is in shock the head is never lowered except in dire necessity, because this position increases venous bleeding.

During the Operation

If the patient comes to the operating room with irregular respiration accompanied by rapid pulse or if this develops before the dura is opened, it may be necessary for the surgeon to do a ventricular tap, which is usually effective because it reduces the cranial contents. A sudden reduction may produce still greater interference in breathing, a sudden drop in blood pressure and a diminution in pulse volume, which usually become adjusted within a few minutes. Circulatory and respiratory changes occurring at any time during the operation should be reported to the surgeon immediately.

If shock occurs from loss of blood during the operation the anesthetist must carry the patient in controlled anesthesia and a special effort must be made to avoid any factors which in turn would increase bleeding in the field, such as obstruction to breathing, cyanosis or the accumulation of carbon dioxide from excessive rebreathing.

Postoperatively

The patient should not be transferred from the operating room table to the bed immediately following the operation unless the patient is in light anesthesia. Sudden changes under deeper anesthesia may interfere with breathing and cause a severe drop in blood pressure. If mucus is present in the upper respiratory tract suction should be used, preferably through the mouth in order to avoid any possibility of nasal bleeding. Intravenous infusion should

be given sparingly because large amounts may produce edema of the lungs, and an increase in blood pressure which in turn may cause bleeding within the cranium.

The blood pressure and pulse should be taken at fifteen-minute intervals until the patient is conscious and thereafter every half hour for the first twenty-four hours.

The percentage of postoperative pulmonary complications is unusually low in this type of surgery. The record of cases studied in this report shows a 1.9 percentage of pulmonary complications in 258 operations.

Apparatus

The machine shown in the picture is the apparatus that we use routinely. We formerly used the Connell Anesthetometer, but any ether-air machine may be used providing it is not operated by an exposed electric motor. The

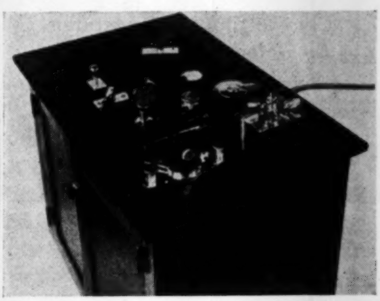

Fig. II

principle of the machine shown is not new, having been used for many years in the research laboratories in the physiological and surgical departments of Western Reserve University School of Medicine. The clinical application is new, however. The machine was constructed at the University Hospitals and is not on the market. It was designed to include the defibrillating unit developed in the surgical laboratory of Dr. Claude Beck, Western Reserve University. (Incidentally, we have had the unique experience of demonstrating on a human the value of this part of the apparatus.)

The resuscitator is operated from the compressed air which is piped to the operating room and the flow of which is automatically interrupted by a device constructed on the principle of a windshield wiper. The rate and volume can be controlled. An ether jar is attached through which the airflow can be regulated and the dosage of ether gauged accurately.

The patient is put to sleep in the usual manner and by direct vision an intratracheal tube is inserted and attached to the tube from the machine

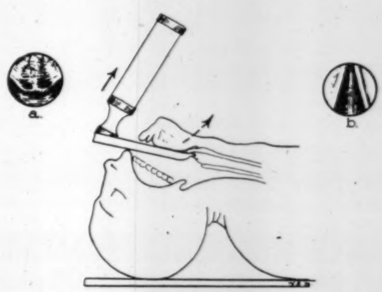

Fig. III
Insertion of tube by direct vision

The escape of air on expiration takes place through an opening in the metal connection attached to the tube leading to the machine. If at any time during the operation the respiration stops or becomes slow, weak or difficult, with an increase in the volume of the air which is being administered interruptedly, normal respiratory movements can be maintained and continued indefinitely. The patient can be kept well oxygenated at all times without any period of interruption.

During anesthesia when the inspiratory and expiratory discharge from the center is well maintained, we have had

relatively little difficulty, since we have learned to use the machine, in adjusting the rate so that the patient breathes in unison with the machine. The ease with which this is accomplished may be due to the operation of the Hering Breuer reflex. The machine should be used as a respirator immediately when the respiration increases in rate and becomes very shallow or periodic.

The value of this machine is demonstrated in the following case report: Male, age 45, entered the hospital July 14, 1937, suffering from severe headache, vomiting—regurgitant in nature, dizziness, staggering gait, drowsiness and interference with speech. Diagnosis: Meningioma, right occipital pole, ventral surface. On July 19, 1937, the patient was given avertin—70 milligrams per kilogram of body weight. The patient was brought to the operating room, and forty-five minutes after avertin was administered the patient was breathing two or three times per minute. Under local anesthesia the right ventricle was tapped and fluid allowed to escape slowly. The respiration did not improve. The patient was placed in the Drinker respirator for three hours, after which time he could breathe moderately well by himself—eight to ten times per minute. An intratracheal tube was then inserted and the apparatus described above was attached. The patient was placed in the cerebellar position and the incision was made and a large tumor removed by Dr. Claude Beck. The patient was returned to the ward semi-conscious, breathing ten to twelve per minute. The following morning he was conscious, able to talk and move his legs and arms. On August 5, 1937, the patient was discharged from the hospital. On December 7, 1938, the patient came to the follow-up clinic feeling very well, quite jubilant over his present condition, and he reports that he is able to do full time work.

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CRAWFORD W. LONG, THE DISCOVERER OF ETHER ANESTHESIA*

EDGAR G. BALLENGER, M.D.

Atlanta, Ga.

It has occurred to me that it would be worth while to summarize for you the life history of Crawford W. Long, who was the first to employ anesthesia during a surgical operation. For nearly thirty-five years I have lived not far from his birthplace and the Georgia town in which he first employed sulphuric ether as an inhalation anesthetic. I was present at the unveiling of two monuments to him—one at Danielsville, his birthplace, and the other at Jefferson, where he first administered ether.

For many years most of my hospital work has been done at the Crawford W. Long Memorial Hospital in Atlanta. At the time of the receipt of your kind invitation to present a paper at this meeting, Mrs. Eugenia Long Harper, the daughter of Crawford Long and his only living direct descendant, was a patient in this hospital. For a number of years I have had the good fortune to know Mrs. Harper, and often I have had the opportunity of hearing her talk of her famous father.

I have also heard Dr. Hugh Young of Baltimore describe the occasion when he, an interne at Johns Hopkins Hospital, met Dr. Long's other daughter, Mrs. Frances Long Taylor. Dr. Young had returned to his home in San Antonio, Texas, where he met Mrs. Taylor at a social gathering. In the course of their conversation she asked him about his work at Johns Hopkins Hospital. He replied that he was at that time administering ether. Much to his surprise Mrs. Taylor told him that her father was the first person to give ether for a surgical operation. Dr. Young inquired as to what evidence she had to prove that her father was the first to employ it. To his further surprise Dr. Young on the following day was shown a satchel full of documentary proof that Dr. Crawford Long had administered ether for an operation in 1842, and again on seven occasions prior to Dr. Morton's announcement of his discovery. Mrs. Taylor then made the evidence available for Dr. Young to study, and he presented before the Johns Hopkins Historical Society on November 8, 1896, a paper with the title "Long, the Discoverer of Anesthesia: A Presentation of his Original Documents" (Johns Hopkins Hospital Bulletin 8, 174-18, 1896-7). In 1928, Mrs. Harper published further details in a book entitled "C. W. Long and Ether Anesthesia".

I also had known Dr. Joseph Jacobs, a pharmacist, who at the time of his death was the owner and head of a chain of drug stores in Atlanta. Dr. Jacobs worked in his boyhood as an apprentice in a drug store in Athens, Ga., owned by Dr. Long, his brother H. R. J. Long and Dr. Hal C. Billups. Dr. Jacobs greatly admired Long and was untiring in his efforts to obtain for him the recognition which he felt was so justly merited. In 1919 Dr. Jacobs published a booklet in which he recited the facts and circumstances of Dr. Long's discovery.

Dr. Frank K. Boland, a surgeon of Atlanta, who for many years cham-

* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

pioned the cause of Dr. Long, has kindly lent me some lantern slides which I will show later.

With facts gleaned from the foregoing sources I shall now present a condensed summary of Dr. Crawford Long's life and his part in the celebrated ether controversy.

Dr. Crawford Williamson Long was a doctor of the old school, retiring and modest. His failure to push his claims as the discoverer of ether lead to much confusion as to priority. Unbiased study of the facts and circumstances clearly indicate that Crawford W. Long administered ether in 1842 and seven times subsequently before W. T. G. Morton, a dentist, proclaimed to the medical and surgical world in 1846 the effects of ether as an anesthetic. It is clearly evident that both of these widely separated and independent workers learned that ether could produce anesthesia. It is also clearly evident that Long was the first to administer ether for the purpose of anesthesia and that Morton was the first to proclaim this fact to the world. Both deserve credit for the part they played in this discovery. Each played his part as conditioned by his environment. Had Long lived in Boston when he made his observation that injuries were painless when sustained under the influence of ether as used in frolics not unlike our cocktail parties of today, he in all probability would have been the first to proclaim to the world the quality ether has of inducing anesthesia. Or had Morton lived in a section remote from centers of civilization, as Jefferson, Ga. then was, he probably would have been retarded just as Long was in proclaiming to the world the facts about anesthesia.

My remarks are in no way intended to detract from Morton and his colleagues the credit they deserve for announcing to the world that ether was a practical agent with which to produce anesthesia, nor will I enter the discussion as to their rights in their efforts to obtain monetary gain from their independent discovery of ether as an anesthetic. Instead, I prefer to tell you of Crawford Long, who was actually the first to discover that anesthesia could be induced by the inhalation of ether, and who was the first to perform surgical operations with the patient anesthetized.

Crawford W. Long was born in Danielsville, Ga., Nov. 1, 1815. He came of fine ancestry and from boyhood until his death lead an exemplary life and one dominated by high ideals. At the age of fourteen he entered Franklin College, now the University of Georgia, where he roomed with Alexander Stephens, who later became Vice-President of the Confederacy. At the age of nineteen Long was graduated with second honors in his class. He and Stephens were lifelong friends and statues of both now stand in the Hall of Fame. Among other distinguished college mates of Long was Howell Cobb, who became Georgia's Governor and Senator and later Secretary of the Treasury under President Buchanan.

Long took his first year in medicine at Transylvania University, Lexington, Ky. He made the trip to Lexington alone, on horseback, from Georgia through the mountains of western North Carolina and eastern Tennessee. This journey was not without its hardships in climbing mountains and fording streams. In 1838 Long entered the medical department of the University of Pennsylvania, where he studied under Phillip Syng Physick and his distinguished colleagues, who at that time drew four hundred students to the medical school. He was graduated in 1839. While in Philadelphia Long

learned of the exhilarating and mirth-provoking effects produced by the inhalation of nitrous oxide gas and ether. Long spent eighteen months in the hospitals of New York and then located in Jefferson, near his home in Danielsville. Jefferson then was one hundred and forty miles from a railroad.

Long had in Philadelphia noted that he and his friends while exhilarated by ether were insensitive to bruises or injuries received on these convivial occasions. After pondering and correlating the facts thus obtained, Long decided that by the use of ether two small tumors situated upon the back of the neck of one of his patients, James M. Venable, might be removed painlessly. Venable agreed to submit to the experiment. Ether was administered on a towel and no pain whatever was experienced during the removal of one of the tumors. This operation was performed on March 30, 1842. Long stated that as an inducement to Venable to submit to the experiment a charge of only $2.00 was made for the operation and 25c for the ether.

Although Long was convinced that ether had rendered the operation painless, his small-town public was far from convinced. Even the "big world" in America, England, and Europe was talking and thinking much of mesmerism, and Braid in Manchester, England, was using his "neurohypnotic trance", and Elliotson of London was writing his book, published in 1843, on "Numerous Cases of Surgical Operations Without Pain in the Mesmeric State." Superstition and ignorance ruled in the "little world" of Long, in and around Jefferson, as well as in the "big world." Details of the story are too long to discuss now. In 1846, the New Orleans Medical and Surgical Journal, advocate of mesmerism, was amazed that the surgeons of Boston could be captivated by the claims of the advocates of ether anesthesia, asserting that a thousand times greater wonders had been wrought by mesmerism and without the danger incident to the use of ether.

With such a background it is not surprising that Long, in an isolated part of the country with little surgical work of his own and no hospital facilities, should have been reluctant to proclaim to the outside world his discovery of ether as an anesthetic. He was advised by his friends to go slowly or to discontinue the use of ether anesthesia, and was greatly disappointed that the older doctors near him were skeptical of his claims. As already stated, Long's daughter later collected documentary evidence of eight successful anesthetizations with ether before September, 1846, the date of Morton's announcement.

Better conditioned though were Morton and his associates in Boston in their exploitation of ether under the name of "letheon." After publication of their account of anesthesia induced by it, Long said that his friends told him he would be doing himself injustice "not to notify his brethren of the medical profession of his priority in the use of ether by inhalation in surgical operations." Concerning Long's desire not to be premature in reporting his discovery, Dr. Dudley Buxton, of London, says that Long's reticence "redounds wholly to his credit." Long never tried to patent or commercialize his discovery in any way.

In 1848, Dr. Paul F. Eve, Professor of Surgery at the medical school in Augusta, invited Dr. Long to appear before his class of medical students. In introducing Long, Dr. Eve said: "While quiet and diffident, he possesses all the requisites for success. He has already mastered a scientific solution that when

properly learned will entirely revolutionize the field of surgery........With heartfelt emotion I greet our guest and congratulate you upon the honor of this acquaintance with a brother doctor to whom the future is bright indeed. I suspend the lecture for ten minutes for the class to shake the hand of such a public benefactor as Dr. Long has proved himself to be."

The famous ether controversy did not start in full blast however until 1849, when Morton petitioned Congress for a reward for his discovery. This was opposed by Dr. Jackson, an analytical chemist of Boston, and by the friends of Dr. Wells, a dentist of Connecticut, who was then dead. The story of the fight of these three for the patent rights of ether under the name "letheon" and for a Congressional award in addition is too long to take up. Suffice it to say that when Senator Dawson arose and said that he had a letter from Dr. Jackson which acknowledged that Long undoubtedly used ether before any of the claimants, the futility of further effort became evident and the bill was allowed to die.

Here the story might very well end with credit going to Long for being the first to use anesthesia and to Morton for being the first to proclaim it to the world. The controversy, however, seems unwilling to die.

In a recent moving picture of the story of Long and Ether Anesthesia (entitled "Anesthesia", by Peter Smith, M.G.M.), Philip A. Wilhite is shown as making the suggestion to Long that ether be used as an anesthetic. Mrs. Harper, Long's daughter, has recently stated to me that this picture came as a disagreeable surprise because of the inaccuracy of the part played by Wilhite, who did not enter her father's office until two years after the first use of anesthesia. Wilhite originally had misstated the facts to Marion Sims and when Wilhite's attention was directed to this misstatement, he made a retraction in a personal letter to Long. Sims sailed for Europe soon after the publication of his article and Long died a few months later. Wilhite's statement then went unchallenged for many years until Dr. L. B. Grandy of Atlanta in the Virginia Medical Monthly showed the error of Wilhite's statement.

The producers of this motion picture undoubtedly do a great injustice to the memory of Long and to his family, when contrary to facts, Wilhite is shown as suggesting the use of ether. In this manner Long's honor is divided with a man who admits, in a sworn statement and in a letter, that he did not enter Long's office until 1844. The stupidity of this inaccuracy on the part of the producers of the picture seems increased particularly by the use of Wilhite to make such a suggestion, as the original records, which may be found in the Congressional Library in Washington, and numerous publications show that he was not present. The moving picture misleads and misstates an essential fact concerning an important medical discovery.

It seems strange indeed that a discovery of such merit as the use of ether as an anesthetic should have carried with it so much of disappointment and tragedy to those most intimately concerned with it. Dr. Long's disappointment at not being generally recognized as its discoverer made the subject of anesthesia a forbidden subject in his own household. Wells, the Connecticut dentist, committed suicide probably on account of his failure to obtain wealth from the patent rights of "letheon". Dr. Jackson, eminent Boston professor of chemistry, died in an insane asylum. Morton, due to his bitter fight with Wells and Jackson over prospective

monetary gain, was temporarily ruined financially and in reputation and finally is said to have died of apoplexy induced by reading one of Jackson's diatribes against him. And now Long's descendants are harassed by having to see his honor erroneously divided with Wilhite.

ANALEPTICS*

LILLIAN G. BAIRD

University of Michigan Hospital, Ann Arbor, Mich.

As new agents have been added to the list of anesthetics, our scientists have kept pace in finding new restoratives to overcome the depression caused by these agents. In years past when an emergency arose and a stimulant was needed, we had only a few to choose from and the action of these was not always understood. The most commonly used were strychnine, adrenalin and caffeine sodium benzoate.

Strychnine is an alkaloid found in several species of strychnos. It has a stimulating action on the central nervous system and especially on the spinal cord. The vasomotor centers are stimulated by small quantities and thereby the blood pressure is raised and the heart beat is improved. Great care has to be exercised in the use of this drug, as too large a dose will produce convulsions and paralyze the respiratory center.

Epinephrine or adrenalin, as it is commonly called, stimulates the sympathetic nerves, which constrict the vessels of the abdominal cavity, causing an increase in the blood pressure. It also has a direct action on the muscles of the vessel walls, as it will also increase the blood pressure if given after the splanchnic nerve has been destroyed. It does not stimulate the respiratory center, but the respirations themselves may be affected by the changes in the blood pressure. The effects of adrenalin are transitory and frequently repeated doses may produce shock by exhausting the constricting muscles of the vessel walls, consequently it is of small value as a restorative, except to raise the blood pressure for a short time while other measures are administered. In cases of collapse, in which it is administered intracardially, it should be given into the right auricle and not into the left ventricle. It should be avoided in cases of hypertension, coronary disease or coronary thrombosis.

Ephedrine is closely related to adrenalin both chemically and pharmacologically, but the solutions of this drug are more stable than those of adrenalin. Its action is very similar, but is less powerful and lasts much longer. It will not only increase the blood pressure, but will maintain it if given early in cases in which a drop of pressure is anticipated. Repeated doses at short intervals have the same effect as that of adrenalin in that the constricting muscles of the vessel walls will tire, thus contributing to shock. As a circulatory stimulant the dose is 3/8 to 3/4 grain, and it requires from 20 to 30 minutes to take effect.

Caffeine sodium benzoate is a mixture of equal parts of caffeine and sodium benzoate given in doses of 7½ grains dissolved in its own weight of water. It

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stimulates the medullary center, increasing the respiratory rate and also improving the circulation, but to a lesser extent than ephedrine.

Since the introduction of avertin and the various barbituric acid derivatives, there has been a need for reliable analeptics and, as usual, the scientists have done their part by giving us several new ones to choose from. In this list are found alpha lobelin, picrotoxin, coramine and metrazol, and recently neosynephrine has been put on the market.

Alpha lobelin is an alkaloid which has been available for several years. It is supposed to be a specific respiratory stimulant, affecting that center only. According to its advocates, its action takes place almost immediately, increasing the rate and amplitude of the respirations, the effect continuing for an hour or more. It has been rather highly advertised for use in surgical or anesthetic shock and also asphyxia neonatorum. Most authorities believe this drug is of little value even in infants but there are others who report good results. The adult dose is 3/20 grain subcutaneously or 1/20 grain intravenously. The infant dose is 1/20 grain intramuscularly or subcutaneously.

Picrotoxin was put on the market several years ago for a restorative. Previous to that time it was thought of only as a member of a group of convulsive poisons, as it causes clonic convulsions because of its action on the central nervous system, especially on the medulla when given in poisonous doses. Investigation has proved that picrotoxin is effective in barbituric depression and that the treatment is reversible in that the latter drug may be used to control picrotoxin convulsions. It has been found that the more rapid acting members of the barbituric group may be treated with fairly large doses of this agent while the slower acting barbiturics must be treated with smaller and more numerous doses. It may be given subcutaneously, intramuscularly, or intravenously, but is most effective when given intravenously. Three milligrams may be given intravenously to start and then one milligram each minute until signs of awakening or convulsive symptoms appear.

Coramine is a powerful respiratory stimulant, but affects the circulation very little. It is even capable of affecting the respirations when the depression is so deep that the central nervous system will not respond to the use of carbon dioxide. After sufficient stimulation from the coramine, the centers will then respond to the carbon dioxide. It seems to have a specific awakening influence and seems especially effective in awakening patients from avertin, but it must be used in adequate dosage to be of any value. Five to ten cc. may be given intravenously or subcutaneously and repeated as necessary. Twenty cc. intravenously may be given over a five minute period and twenty cc. subcutaneously for a powerful effect.

Metrazol is a camphor derivative which should be classed as a restorative rather than in the broader group of stimulants because it tends to restore the circulation to normal rather than to overstimulate. In depression it stimulates the vasomotor center in the medulla and this impulse is transmitted to the walls of the peripheral vessels, restoring their tone, thus tending to raise the blood pressure to the normal level. It is not thought to have any action on the heart muscle, but there is some evidence that it causes a dilatation of the coronary vessels, thereby improving the circulation to the heart muscle and improving its action. It is thought to sensitize the respiratory cen-

ter to carbon dioxide, thus bringing about its stimulating effects in cases where the centers are so depressed as not to respond to the carbon dioxide. In cases of marked depression it tends to return the patient to consciousness. Besides being of value in shock or depression it is recommended for asphyxial neonatorum, pneumonia and congestive heart disease. It may be given in doses of 3 to 4 cc. intravenously and 2 to 3 cc. subcutaneously and repeated in ten minutes. It may then be repeated whenever the effects begin to wear off.

Dr. Burstein and Dr. Rovenstine of Bellevue Hospital have investigated metrazol, picrotoxin and coramine extensively.[1] They obtained better results from individualizing the dosage for each patient, and found that fractional doses were more satisfactory. Intramuscular doses proved as effective as intravenous, but were less rapid in action.

In morphine depression they favored metrazol, but they found its action transitory, it being sometimes necessary to repeat the dose in ten minutes. Two or three doses intravenously followed by a similar amount intramuscularly are usually sufficient to relieve severe depression from morphine. They also found picrotoxin effective in this type of cases, but coramine was not so satisfactory.

In ether, paraldehyde, and cyclopropane depression they recommended metrazol, picrotoxin and coramine in the order named. In avertin depression they found coramine of more value than metrazol, and picrotoxin of the least value.

In depression from the barbituric acid derivatives they had better results from metrazol than from picrotoxin and the poorest results from coramine. In fact they found some instances when coramine seemed to increase the duration of the narcosis and retarded the recovery.

In spinal anesthesia, they did not believe that these drugs relieved the falls in blood pressure, the impaired respiratory ventilation, and the vomiting. They also did not advocate their use in surgical shock unless the patient had received an overdose of a sedative.

In the past few months we have been using some neosynephrin. This is closely related to ephedrine and epinephrine both chemically and pharmacologically. They all belong to the sympathomimetic group of drugs, that is, their effects are similar to those producing stimulalation of the sympathetic nervous system. But these three drugs all differ in their action. Epinephrine has a more intense, but less enduring action than either of the other two, while neosynephrin is the less toxic.

Dr. Tainters, of Stanford, has studied this agent very thoroughly and recommends its use in conditions requiring the maintenance of blood pressure, as in spinal anesthesia or wherever shock is anticipated as well as in cases where shock has developed.[2] It will increase the blood pressure without increasing the pulse rate and may be repeated at intervals without loss of effect, as is true of epinephrine and ephedrine.

It is available in rubber-capped vials containing a 1 per cent solution which contains 10 milligrams in each cubic centimeter. The dose subcutaneously is 2½ to 5 milligrams, which will last from one to two hours. One half of this dose may be given intravenously, that is, 1¼ to 2½ milligrams, but its effects will last only about fifteen minutes when given in this manner. The subcutaneous doses may be repeated as necessary, as it is not accumulative.

There is one other analeptic which I might mention which is being investigated but is not on the market as yet.

This is adrenalin in peanut oil. The oil is supposed to prevent the adrenalin from being absorbed too rapidly, thus prolonging its action. It is put up in 1 cc. ampules, which contain 1 milligram of adrenalin. The whole ampule may be administered. It takes effect in from ½ to ¾ of an hour and will last from four to five hours.

For a very powerful stimulant where a restorative is needed immediately, some authorities recommend 5 cc. of coramine and 1 cc. of postpituitary lobe extract, given intravenously. This combination must be used with great care, but will prove effective if given early enough, where all other agents have failed.

Of course, all other prophylactic and therapeutic measures should be used with these analeptics and should be used early, as it is much easier to prevent depression or shock than to restore the patient to normal after these conditions have become established.

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HELIUM AND ITS CLINICAL APPLICATION*

HELEN LAMB, Chief Anesthetist
Barnes Hospital, St. Louis, Mo.

Helium, the lightest and most diffusible but one of all known gases, is the newest addition to our list of gaseous therapeutic and supplementary anesthetic agents.

Historically, it may be noted that while the presence of helium in the sun's atmosphere was discovered some two generations ago (in 1868 to be exact) its existence upon our own earth was not demonstrated until something less than fifty years ago, and its commercial use from the time of its discovery until very recently has been limited practically entirely to substitution for the more inflammable gas hydrogen, as an inflatant for balloons and dirigibles.

The outstanding characteristics of helium are its non-inflammability, its pharmacological inertness, its extremely low density and its high diffusibility; the latter three of which constitute its especial value in the fields of oxygen therapy and general anesthesia.

To illustrate concretely the merit of its feature of *low density*, and the consequent basis for its usage in procedures which will be mentioned later in this paper, let me point out that the force (effort) required to move a given volume of gas, whether it be within the respiratory tract or elsewhere, is proportional to the molecular weight of the gas so moved; which statement, when translated into terms of our pres-

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ent subject, means that helium (with a molecular weight of 4) requires only about one-seventh as much force to start it moving back and forth in respiration, as does air, whose molecular weight is 28.8. By the same token, helium requires only about one-eighth the force to start it moving back and forth in respiration, as does oxygen, whose molecular weight is 32. The saving, or conservation, of physical effort which is afforded by the inclusion of helium within breathed atmospheres, is at once apparent.

To similarly illustrate the feature of helium's *high diffusibility,* let me first cite the formidable sounding, but inescapable, formula which states that "the diffusibility of gases is inversely proportional to the square root of their molecular weights"; which when translated into terms of the gases with which we are at present concerned, simply means that for instance in the case of oxygen, helium is more than two and three-fourths times as diffusible as oxygen, and in the case of cyclopropane, is about three and one-fourth times as diffusible as cyclopropane, and therefore when mixed with those gases facilitates their flow to, and distribution in, the more distant lung areas.

Upon the basis of the foregoing named characteristics of helium which are bringing it prominently into our field (pharmacological inertness, low density and high diffusibility), the pioneer in this field, Barach, in 1934 experimentally introduced helium to clinical oxygen therapy, by administering to subjects a mixture of helium and oxygen in place of ordinary air, demonstrating thereby that a properly calculated helium-oxygen mixture, while possessing all the oxygenating value of air, presents 25 to 50 per cent less resistance to the subject, and results in an increased tidal volume. Upon that and later work by the same investigator, has grown up the present accepted use of helium in oxygen therapy, particularly for those patients in whom respiratory obstruction exists (asthmatics, et cetera), and for those cases in which respiratory fatigue is a factor.

These same three features of helium have led to its use *during anesthesia,* both by intermittent administration as indicated, and as a regularly calculated part of the anesthetic mixture, with patients in whom respiratory obstruction exists or has developed, such as a stridor caused by spasm of the vocal cords. In this connection, however, it is to be fully borne in mind, as Eversole has pointed out, that there is no substitute for a clear unobstructed airway; although the inclusion of helium in the anesthetic mixture does in certain cases permit smooth administration of anesthesia without inserting a tracheal catheter which might otherwise be necessary and in some emergencies does prove of distinct value until the tracheal tube can be inserted.

In using helium as a part of an anesthetic mixture, it must be remembered that being so far as is known completely inert, it possesses neither oxygenating value nor anesthetizing power, and therefore by the measure of its own volume dilutes both the oxygenating and anesthetizing concentrations of the mixture. In view of this, it can be incorporated with only exceedingly potent agents such as cyclopropane or ether, where the margin of oxygen is always so wide that the encroachment thus made upon it will not reduce it to asphyxial concentration. And it is equally clear that the inclusion of helium within an anesthetizing mixture, should be according to a technique which has been carefully calculated with reference to its ultimate ef-

fect upon the concentrations of both the anesthetizing gas and the oxygen.

A technique calculated with regard to these principles, consists in the administration of helium at the same time as, and based upon the delivery of, the cyclopropane—one-third helium with two-thirds cyclopropane. In appraising the eventual composition of a mixture so administered, interest attaches to the very complete analytical results published by Waters and Schmidt, which show that in the study of some 2,000 cases of cyclopropane-oxygen anesthesia, the oxygen content of the mixture in no case fell below 49 per cent in the deep surgical zone of narcosis (excluding overdose of course, the approach of which being identifiable clinically, is avoidable).

It is also to be noted that in that same published series, the concentration of cyclopropane during the surgical stage of anesthesia was in no case higher than 27 per cent and in no case lower than 21 per cent, from which we may deduce that when helium inclusion in the mixture is proportioned to the cyclopropane delivery (one-third helium and two-thirds cyclopropane) the variations in eventual helium concentration will be proportionately limited; from a high of probably 13 per cent helium, to a low of probably 10 per cent. Obviously, if that inclusion of helium is entirely at the expense of oxygen alone, the oxygen content of the mixture will still remain at over 35 per cent. As a matter of fact, the helium displaces not merely oxygen from the mixture, but also some of the systemic free nitrogen, so that even a higher oxygen content than the estimated 35 per cent is undoubtedly present.

Incidentally, it may be mentioned that a technique providing broader helium provision than above, is at present being studied (based upon administration of *equal volumes* of helium and cyclopropane). The composition of the administered mixture during surgical narcosis is estimated to include 21 to 27 per cent cyclopropane, 21 to 27 per cent helium, 22 to 25 per cent oxygen. The technique is now in process of development, but awaits further clinical and laboratory confirmation.

I quite realize that a theoretical objection could be raised to the above stated methods of apportionment, on the ground of a possibility of slight building up of helium concentration, by reason of lesser circulatory removal of that gas from the mixture, than of cyclopropane. To offset this, however, there is the fact that by reason of its much greater diffusibility, the mechanical losses of helium will be greater than those of cyclopropane, in addition to which is the fact that some helium does pass into the blood stream to replace part of the free nitrogen—so that what, if any, increase in helium concentration does take place, seems to be entirely within the limits of permissibility. Clinical experience with the technique has certainly evidenced no contraindication to it.

Another particularly interesting aspect of the use of helium as part of an anesthetic technique, revolves around its stated usefulness in reducing the incidence of postoperative complications. Its special merit in this connection lies in not merely its already discussed ease of flow and rapid diffusion, but especially in its property of very low solubility in the moisture-laden tissues which intervene between the alveolar air and capillary circulation, through which tissues, of course, all gases must pass in exchanging from alveoli to circulating blood. This particular phase of the use of helium is based upon theories which are currently advanced to explain the phenomenon of atelectasis

and its subsequent chain of infectious pulmonary pathology.

And leading into this subject, may I point out that it has been editorially stated (J.A.M.A.) that "atelectasis is the most important of postoperative complications"; and while such statement may or may not be categorically correct, there is good evidence indicating that there may be *more than one phase or kind* of atelectasis, and that there may be *more than one cause* for it.

As to the fact of atelectasis, Corryllos and Birnbaum have shown that when pulmonary circulation is functioning and is therefore normally taking up alveolar air, and when the pulmonary endothelium is intact and is therefore normally transmitting alveolar gases through it to the circulation, if then a complete bronchial obstruction is brought about, and maintained for a sufficient length of time to permit the gases distal to the obstruction to be absorbed by the circulating blood, atelectasis actually does develop. Further than this, postmortem findings have shown atelectasis to exist, even in cases where there had not been an actual mechanical stoppage; and in these circumstances it has been proposed by Burford that there are or may be two types of atelectasis—one of them the typical one in which mucus plug or other obstruction exists (with consequent absorption of gases distal to the obstruction, and thereupon collapse of the structure no longer inflated) but the other of them a quite different type, which while culminating in the same collapsed end-result, is due not to mechanical stoppage, but instead to hypoventilation or low minute volume of respiration, which fails to furnish aerating or mechanically sustaining gases to the alveoli in such volume or at such speed as is necessary to offset the rate of absorption of the gases from the alveoli by the circulating blood.

In this exact connection, therefore, particular emphasis is placed upon including within the anesthetic mixture, a gas of not only highly mobile and rapidly diffusing characteristics, but also one of low solubility in, and slow absorption through, the pulmonary endothelial tissue which surrounds the alveoli. The same emphasis is, for the same reasons, placed upon the use of such a gas at the conclusion of an anesthesia, to inflate and protect against collapse, the distal lung areas.

Experiment indicates that the gas most nearly ideal for the purpose required is helium, although at first blush it sounds contradictory to propose for low solubility application, a gas whose characteristic is high diffusion. The explanation of this seeming inconsistency lies in the fact that the solubility factors of the gases result from quite different laws than do their diffusion factors. In other words, while speed of diffusion is according to molecular weight, the degree of solubility of these gases has been empirically determined experimentally, and a "solubility coefficient" assigned to them.

In fact, this solubility coefficient for the exact gases with which we are at present concerned, and therefore the relative lengths of time they may be expected to remain in terminal lung structure, before disappearance into the blood stream and consequent collapse of the uninflated structure (atelectasis), has been determined by Corryllos and Birnbaum by a series of experiments in which a lobe of one lung of a living dog, was first rendered atelectatic by evacuation of its atmosphere, and was then inflated to full inspiratory state by the gas named, and was then studied with particular reference to the length of time elapsing before the occluded

lobe completely emptied itself of the gas with which it had been inflated.

Their results showed that while carbon dioxide evacuated into the circulating blood in four minutes, and oxygen in fifteen mintes, the gas helium required over twenty-six hours for complete emptying of the lung structure—a certainly striking endorsement of the proposal of this gas for inclusion, when practicable, within the anesthetic mixture, and as an inflatant of distant pulmonary areas for defense against collapse during surgery or during the period of the patient's postoperative low respiratory activity subsequent to return to his room.

Now, in approaching the conclusion of this paper, I remember the very practical problem which faces the anesthetist who desires to use helium developmentally before the anesthetizing machines have been calibrated for that gas. In such circumstances, the helium must of necessity be administered through a flow meter whose calibrations relate to a gas of quite different density and flow characteristic. So for whatever assistance or interest it may carry in this connection, I have tabulated below, a flow value for helium when it is delivered through flow meters which have been accurately calibrated for the several gases with which current anesthetizing machines are generally equipped. These flow values or "flow factors" have been calculated by the standard formula to which I have referred earlier in this paper, namely, that "the volume of flow of gases through small orifices is inversely proportional to the square root of their molecular weights"—which merely expresses in exact values, the obvious fact that the thinner a gas is, the more rapidly will it flow through a small opening, all other conditions being equal.

CONVERSION TABLE or FLOW FACTOR TABLE

TABLE I

Name of gas	Molecular symbol	Molecular weight	Square root of the molecular weight
Helium	He	4.	2.000
Oxygen	O_2	32.	5.6569
Nitrous oxide	N_2O	44.	6.6332
Ethylene	C_2H_4	28.	5.2915
Cyclopropane	C_3H_6	42.	6.4807
Carbon dioxide	CO_2	44.	6.6332

CALCULATION OF FLOW FACTORS

TABLE II

Inverse proportion — Flow factor

Helium delivered through
Oxygen flow meter

$$\frac{\text{sq. rt. Oxygen} \quad 5.6569}{\text{" " Helium} \quad 2.0000} = 2.8285$$

Helium delivered through
Nitrous oxide flow meter

$$\frac{\text{Nitrous Oxide} \quad 6.6332}{\text{Helium} \quad 2.0000} = 3.3166$$

Helium delivered through
Ethylene flow meter

$$\frac{\text{Ethylene} \quad 5.2915}{\text{Helium} \quad 2.0000} = 2.6457$$

Helium delivered through
Cyclopropane flow meter

$$\frac{\text{Cyclopropane} \quad 6.4807}{\text{Helium} \quad 2.0000} = 3.2403$$

Helium delivered through
Carbon dioxide flow meter

$$\frac{\text{Carbon dioxide} \quad 6.6332}{\text{Helium} \quad 2.0000} = 3.3166$$

Multiply by the above "flow factor," the reading of the flow meter through which the helium is being delivered. The resulting figure will represent the volume of helium being actually delivered through the flow meter for which the flow factor is calculated.

From this table it will be seen that when helium is administered, for instance, through the nitrous oxide flow

meter, its actual volume of delivery will be 3.3 times the volume indicated by the meter. In other words (and to use figures which may be met with clinically) when the nitrous oxide flow meter reads 2¾ litres, the volume of helium passing through it will be approximately 9 litres (3.3 times 2¾ litres).

As a matter of fact, at our own hospital we have found it a very convenient and practical method, in administering helium and oxygen postoperatively by some of our machines not calibrated for helium, to deliver the helium through the nitrous oxide valve, our clinical practice being to administer as a termination to the brief hyperventilation, a mixture of 25 per cent oxygen and 75 per cent helium, at the rate of approximately 12 liters a minute—our actual *flow meter readings* to accomplish this result being "3 liters of oxygen through the oxygen meter" and "9 liters of helium through the nitrous oxide meter, the *actual meter reading* being 2¾ liters." When breathing bag is full, gas flows are discontinued, and the administration (closed circuit) is continued for eight to ten breaths, to insure establishment of the new gas within even the distant lung areas.

SUMMARY:

The administration of helium with oxygen has proved to be of definite value in oxygen therapy; to reduce the effort of breathing in cardiac cases, and to relieve the distress incident to obstructed respiration in asthma and allied conditions.

The usefulness of helium during anesthesia has also been demonstrated as benefitting a developed respiratory obstruction, and in correcting severe stridor. It has also proved of value as an aid to breathing in partial respiratory paralysis caused by spinal anesthesia.

Helium is proposed as a constituent of the anesthetic mixture during cyclopropane anesthesia, to improve ventilation of distant lung areas through narrowed passages, and to defend against atelectasis from low inflation supply or high absorption; the administrative technique to be so calculated as to protect full integrity of the oxygenating content of the respired mixture.

Helium with oxygen (75 per cent helium, 25 per cent oxygen) is also proposed as a routine termination to postanesthetic ventilation, to reduce the incidence of postoperative pulmonary complications.

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THE NON-BREATHING NEW BORN*

EVELYN HURFF, Director, School of Anesthesia
Charity Hospital, New Orleans, La.

The obscure origin of active and rhythmic respiration in the new born has long been a problem to science. Theories regarding the process of respiration with the successive steps in its production have progressed from the time of Aristotle, who thought the main function of respiration was to regulate the body heat which was produced by the heart. Other philosophers of that time thought that the body received its necessary elements for life from the air, which they designated as the "pneum." Philosophers of each century tried to explain facts as far as were known at their time. [1]

The first physiologists thought that the fetus made spontaneous respiratory efforts at birth.[2] This belief has been disproved and the theory that the fetus continues with an already established function after birth has been proved by many. In 1905 Ahlfeld published graphic records showing that the fetus makes rhythmic respiratory movements weeks and months before delivery.[3] These respiratory movements are, however, too weak to dilate the lung. A baby at term has to exert the whole force of the respiratory muscles to inhale air and many inspirations are required before the alveoli are completely distended.[4]

The Respiratory Apparatus

In the fetus and new born the lungs are airless before the first breath is taken, the parenchyma is fleshy in consistency, dark in color and sinks in water. This solid viscous mass completely fills the thorax. With the first respiration, the thoracic cavity expands and the diaphragm contracts. This expansion and the elastic recoil of the thoracic muscles leads to the formation of the intrapleural "negative pressure." The lungs dilate little by little and finally are completely expanded. This expansion is accomplished, according to Arthur Keith, "as opening like a lady's fan." The capacity of the lungs during the first few hours does not exceed thirty to fifty cc. (Henderson, Wasson, Von Reuss, Dorn, and Recklinghausen), and it often takes several days for the lungs to become completely expanded.

The average normal baby's mouth will admit one adult finger. The pharynx when relaxed will admit the tip of the finger up to the attachment of the epiglottis. The distance from the gums to the glottis is about three inches. The distance from the epiglottis to the glottis is very short. The opening of the glottis varies from three to five millimeters in the vertical diameter, and transversely from two to three millimeters. The trachea measures about three inches from the glottis to the bifurcation.[5]

The soft parts of the air passage during relaxation are collapsed and the tracheal rings are easily compressed. This relaxation, thereby favors a responsive adjustment to the mechanism of artificial respiration. The anatomy should be completely understood and experience obtained on cadavers; for a baby suffering from anoxemia should have an operator who can give skilled service based on anatomical study.[6]

In the management of labor the trend

* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

of modern times is to provide the mother an abbreviated, painless labor, with the serious risk of giving her a dead baby due to asphyxia. The fetus seems to be more sensitive to the depressant effects of anoxia than mature organisms (Henderson and Haldane). The fetus is also very sensitive to narcotic drugs. During the second stage of labor as the fetus passes through the birth canal the head is usually compressed or deformed, the blood through the umbilical vessels is obstructed and even the blood supply to the vital centers in the medulla may be completely shut off or an intracranial hemorrhage may occur, thus producing severe anoxia.

Any alteration in the maternal blood chemistry immediately affects the placental blood. Therefore if the mother is excessively drugged or through prolonged labor becomes cyanotic and develops a lowered muscular tonus, asphyxia tends to develop in the fetus. This anoxia in the fetus weakens the heart action, lowers the sensitivity of the respiratory center, and lowers the ability to develop muscular tonus at birth. If acapnia develops in the maternal blood from overventilation, severe pain, or excitement, apnea tends to develop in the baby, with depression of the respiratory center. If the carbon dioxide supply is deficient, the blood cannot have the proper supply of oxygen. By inhalations of carbon dioxide and oxygen, the mother's blood supply improves the tonus of the laboring muscles and that of the placenta and fetus. The fetus is therefore more fit and inclined to breath spontaneously at birth.

The period immediately after birth is very important. If respiration is not established life will be extinguished, for the fetus no longer has the maternal supply of oxygen.[7] After respiration has been established it is most important that chemical regulation of the blood be continued until vitality, muscular tonus, respiratory metabolism and heat production have been established, and the lungs are completely inflated.

Yandell Henderson, Haggard, and Haldane and his co-workers state that "Respiration is under a chemical control by the more or less direct action of the arterial blood, chiefly through its content of carbon dioxide on the respiratory center in the brain."[8] They also state that it has been proved that oxygen is not a stimulant. A slight deficiency of oxygen is to some extent a stimulant, but only for a short time. If the deprivation of oxygen is prolonged, the stimulation then passes into a depression. Oxygen being the essential foodstuff, without oxygen the tissues cannot produce carbon dioxide.[9] In the resuscitation of the new born the aim should be to induce tonus of natural breathing at the earliest possible moment. In the light of modern science the following methods are inadequate or even harmful to the baby, if used inadvisedly:

1: Compressing the thorax of the baby in which the lungs are still completely atelectatic cannot draw air into them. Even after the lungs have been distended, manual compression and artificial respiration can only induce expiration. Inspiration is the recoil of the chest produced by the muscular tone. Therefore, squeezing, pulling, or stretching of the body or moving the body feetward and then sharply headward will not in the least establish the essential muscular tonus.

2: Afferent stimulation such as plunging into cold water and then hot water, slapping and kneading, or anal dilatation produce a reflex gasp only.

3: Mouth to mouth insufflation has for many centuries been used, but care

should be taken not to exert force; the basis of such method is the gentle inflation of the bronchial tree and stimulation by the operator's exhaled carbon dioxide.

The modern treatment of asphyxia is the administration of a mixture of carbon dioxide and oxygen by inhalation or insufflation under a controlled pressure after the mouth, pharynx, and trachea have been cleared of mucus or any other foreign material by suction.

Objections to the Use of Carbon Dioxide

Eastman objects to the use of carbon dioxide on the basis of an intensive study of asphyxia neonatorum.[10] He found that there was a low blood oxygen, a high lactic acid content, decreased alkali, and an abnormally high concentration of carbon dioxide in asphyxia pallida. He feels that such a condition constitutes an acidosis in the sense of an acid intoxication and that the administration of carbon dioxide would only aggravate the abnormalities in the blood chemistry already present. Henderson, on the other hand, on the basis of a wide experience with therapeutic inhalations of carbon dioxide, reported that in no instance was there an increase in acidosis from this procedure. Instead, it was his experience that inhalations of carbon dioxide tended to relieve acidosis by recalling alkali to the blood. Furthermore, Henderson, on the basis of his experimental data states that asphyxia does not induce acidosis.

Unlike carbon monoxide poisoning, the new born has no foreign gas to be ventilated out of the blood. In both of these forms of asphyxia, however, carbon dioxide is needed to stimulate the respiratory center and muscular tonus. Some babies do not respond to the stimulus of 5 per cent carbon dioxide. Higher percentages of carbon dioxide are then required to stimulate the respiratory center and establish muscular tonus. This is generally true of those babies born in deep narcosis, in which the sensitivity of the respiratory center is depressed by drugs.

Types of Asphyxia in the New Born

Asphyxia is a deficiency in oxygen. Besides the depressions induced by narcotics the forms of asphyxia in the new born may be divided into four types.[11]

1. Asphyxia livida: The baby is very cyanotic and the cutaneous veins are greatly engorged. This condition is brought about by some interference with the circulation between the baby and the placenta during the time of delivery. The umbilical cord may be found tight around the neck. This period is usually not long enough to cause a severe depression of the circulation and respiratory center, so that inhalations of carbon dioxide and oxygen are usually sufficient to establish respiration and muscular tonus.

2. Asphyxia pallida: Due to a failure of circulation. The capillaries and veins of the skin are empty. The heart sounds are weak and slow if present at all. Respiration is greatly depressed and there is a complete absence of muscular tonus. Complete muscular flaccidity results in the blood stagnating and the venous return is insufficient to supply the heart. This is not a vasomotor nervous system involvement; therefore heart stimulants will not be helpful. Inhalation of carbon dioxide and oxygen directly into the trachea is the most effective measure, establishing a rhythmic automatic respiration as soon as possible.

3. An asphyxia which usually develops after delivery is the result of compression of the head during delivery,

thereby producing intracranial hemorrhage. As the seepage of blood from the ruptured vessels gradually compresses the medullary centers the blood supply to the centers is diminished and asphyxia is produced. The sensitivity of the respiratory centers is correspondingly diminished. Respiration gradually fails unless oxygen is supplied.

4. Asphyxia is produced if meconium or other detritus has been drawn into the trachea and bronchi. Clearing the trachea by means of aspiration is of great importance, then depending upon the degrees of asphyxia present, inhalations of carbon dioxide or insufflation of carbon dioxide and oxygen will relieve the asphyxia.

Every nurse anesthetist should acquaint herself with the types of resuscitation and know what not to do and what to do if a baby does not start breathing spontaneously.

The specific things not to do for the nonbreathing new born may be listed as follows:

1: The baby should not be handled or treated with even the slightest degree of roughness.

2: The baby should not be allowed to get cold or be stimulated by plunging into cold and then hot water.

3: The baby should not be subjected to ancient unphysiologic procedures, such as anal dilatation or allowing blood to escape before the cord is tied.

The specific positive factors which will benefit the non-breathing should be followed closely:

1: The baby should be kept warm, for the heat-regulating centers are not developed as yet.

2: If the baby does not breathe from the stimulus of its own blood gases there are only two aids which will be of proper benefit to the non-breathing new born. First, clear the air passages by mopping out the mouth and "milking out" the trachea, using suction if the foregoing is not effective. Second, give inhalations of carbon dioxide and oxygen, or oxygen, as ordered by the doctor, which should be continued until rhythmic respiration will continue without them. A close-fitting mask over the face and a small rubber rebreathing bag attached to a machine delivering the desired flow, under a controlled pressure, compressed ten to fifteen times a minute will usually suffice to inflate part of the lung; then under the influence of continued inhalations, the respirations will become deeper and completely inflate the lung.

For cases of profound asphyxia in which the baby is entirely flaccid, the mixture of gases should be administered by insufflation through the trachea almost to the bronchi. [12] This is accomplished by the Meltzer-Flagg technique, as follows: A suction is inserted through the trachea with the aid of a direct laryngoscope, suctioning any foreign material, then insufflating with carbon dioxide and oxygen directly into the lungs. An intrabronchial positive pressure not to exceed twenty-five millimeters of mercury may be used.

SUMMARY

The basic problems of resuscitation are: 1. The clearing up of any respiratory obstruction. 2. Bringing carbon dioxide and oxygen into direct contact with the bronchial and capillary circulation, permitting thereby, support and stimulation to the depressed respiratory center. When these are accomplished without undue trauma, material is provided for a basic routine.[13]

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ANALGESIA AND ANESTHESIA IN OBSTETRICS*

IONE WESSINGER

Department of Obstetrics, Henry Ford Hospital, Detroit, Mich.

Women have become "analgesia conscious." The experience of others has taught the prospective mother to demand relief from pain during labor. In general, it is reasonable to promise her that she will be relieved from some, if not all pain during labor. Certain reservations should be made, for not all individuals respond to the ordinary analgesics. Furthermore, the welfare of the mother and the child must be protected.

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Analgesia has developed quite remarkably in the past two decades. Many drugs and combinations of drugs have been tried. Some have been discarded while others have been retained. At present, there is a wide range for choice among the methods of analgesia. The selection of the drugs as well as the method of application depends upon the individual patient and the physician prescribing. Among the drugs commonly used the following may be mentioned: the barbitals—sodium amytal, pentobarbital, cyclopral and seconal; the opium derivatives—morphine and pantopon; scopolamine; avertin and paraldehyde. Various combinations may be chosen. Among the anesthetics used for anesthesia or analgesia are ethylene, nitrous oxide, ether and chloroform. For home deliveries chloroform enjoys considerable popularity because it is easy to carry and to administer. Cases of chloroform poisoning have restricted its more general use. Ether tends to increase the bleeding. Ethylene is dangerous for prolonged but interrupted anesthesia and analgesia on account of its inflammability. While nitrous oxide produces cyanosis if not given with sufficient oxygen, it appears to be the safest of all anesthetics if due caution is observed to avoid cyanosis. It is particularly valuable as a supplemental analgesia during the second stage of labor.

It is preferable to administer the anesthetics by inhalation, for they are much more readily controlled in this manner than when given by rectum or intravenously. There are some, however, that cannot be given by inhalation, such as avertin, which is given by rectum; paraldehyde, given either by mouth or rectum, and the opium derivatives and scopolamine, which are used hypodermically. The barbitals are given by mouth.

In our obstetrical department, the patients are instructed to enter the hospital as soon as they know that labor has begun. During the prenatal care, the patient is given a complete physical examination and a complete history is recorded. An attempt is made to study her emotional nature to determine whether she is excitable or phlegmatic. The choice of analgesia depends to a great extent upon her personality. The patient is instructed as to what she may expect from the analgesia. She is told that ideally she is not to expect complete oblivion but rest between pains. During the pain she will probably react and have a vague consciousness of what is going on and be able to cooperate when told to do so. Furthermore, she is told that if the labor is very short, she may not receive any analgesia but her hard pains will be alleviated by receiving gas during the pain.

No routine is followed but each case is individualized. The average patient receives from 3 to 6 grains of pentobarbital as soon as the pains are well established. This may be accompanied or followed by 1/200 of a grain of scopolamine. The pentobarbital or scopolamine or both are repeated when the effects begin to wear off. All analgesics are ordered by the physician. An attempt is made to estimate the probable time of delivery and drugs are not given shortly before the baby is born. Although no harm has been observed in those cases in which the estimate was inaccurate and the baby was born near the time of administration of the analgesic, the controversy on this point is recognized. It is our aim to relieve the second stage pains by nitrous oxide rather than by analgesics.

Orientation may be lost with only a small dose of the drugs and for that reason the patient is protected by hav-

ing a nurse with her constantly. In addition to watching the patient, the nurse gives her fluids freely and sees that the bladder is kept empty. Solid foods are not given because of the danger of aspiration.

When dilatation is complete the patient is placed on the delivery table and nitrous oxide administered with the pains. Analgesia and not anesthesia is desirable at this stage. For performing an episiotomy or when the baby's head passes over the perineum, the nitrous oxide is increased to induce anesthesia. If this cannot be accomplished without cyanosis, a little ether is added, but this is seldom necessary. Anesthesia is maintained until the delivery is completed and the episiotomy is repaired. Then the patient is flushed with carbon dioxide and oxygen and the nitrous oxide is withdrawn. In a few minutes she responds to conversation directed to her.

If an ideal level of analgesia and anesthesia has been reached, the patient remembers nothing after receiving her first dose of pentobarbital. Although she responds when spoken to and cooperates during the second stage, it is not uncommon to have her awaken hours afterwards and ask when she is going to have her baby. It is a controversial point whether analgesia prolongs labor. There are some instances in which labor seems to proceed more rapidly after analgesia is induced. It is also controversial whether analgesia may affect the baby unfavorably. It is difficult to obtain proof for or against this. In our experience we have seen nothing that could justly be explained as damage to the baby from analgesia.

The effect on the mother is remarkable. She no longer fears childbirth. Many remark, "That was not bad. I would not mind having another baby now." It conserves the mother's strength and shortens her convalescence. Methods are continually being improved, but even now analgesia in its present stage of development is a boon to mothers.

PREANESTHETIC MEDICATION*

ROSALIE McDONALD

Emory University Hospital, Emory University, Ga.

When I chose preanesthetic medication as the subject of this paper, I was not unaware of the fact that much had been written and said on this subject in the past. But in spite of this I suspect that there is no other phase of the subject of anesthesia concerning which there is a wider variance of opinion. One of my reasons for attempting a discussion of this subject is the anticipation that it will provoke active discussion, thereby bringing out experiences and usages that have been developed within the last several years, during which time there have been some radical changes in opinion.

The preanesthetic medication to be considered in this paper is limited to that which has a direct bearing upon the anesthesia.

The widely practiced custom of ordering routinely ¼ grain of morphine

* Read at the fifth annual meeting of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 15-16, 1939.

with $\frac{1}{150}$ grain of atropine as a preliminary drug for every operative patient with utter disregard of weight, age, physical condition, type of operation to be performed, and choice of anesthetic agent to be administered should be strongly condemned. The success of any anesthetic procedure is to a great extent dependent upon adequate preanesthetic preparation and such preparation requires consideration of a goodly number of commonly related factors and attention to many details.

The ultimate aim of every conscientious anesthetist is to make anesthesia as safe and as pleasant as possible for the patient. Toward this end preliminary medication has been used for a number of years. Following the development of a highly specialized technique in the administration of the growing list of available anesthetic agents there is added to the picture the more complex problem of a growing list of non-volatile drugs that may be administered preliminary to anesthesia. A thorough understanding of these drugs and of their advantages and disadvantages has inaugurated a new conception of the possibilities involved in the use of hypnotic drugs as adjuvants.[1] There is a growing tendency to discard empiricism and to simplify and rationalize preanesthetic hypnosis.

In order for the patient to reach surgery in an ideal condition there are several factors to be considered. Psychic fear should be lowered to a minimum, and there should be a depression of metabolism and lessening of the reflex irritability without depression of circulation, respiration, or decompensation of the normal bodily functions. The patient should be protected against possible unfavorable reactions characteristic of the anesthesia to be administered or the operation performed.

One of the salient purposes of preanesthetic medication is to alleviate fear and promote a calm psychic state in the patient. That this condition is most desirable is evidenced by the fact that fear is definitely known to aid in the production of reactions unfavorable to anesthesia and operations. A frightened, apprehensive patient will retain distressing mental impressions of his experiences regarding anesthesia and operation which may unfavorably influence him in his future surgical relationships.

Cannon has shown that actual physical changes may be caused by violent emotional disturbances such as psychic shock, anxiety, and fear[2]. As human beings endowed with comprehending minds we suffer mental as well as physical injury, and it is a well-known fact that intense fear of any event or occurrence produces a damaging and lasting psychic effect. The use of preanesthetic drugs will produce psychic sedation as well as materially aid in inducing in the patient a state of indifference to his surroundings incident to the surgical procedure. While this condition is highly desirable in adults, it is equally important in children, for whom preanesthetic medication is considered unnecessary by many. Practicing anesthetists who come in contact every day with patients who have previously been anesthetized have occasion to observe the consequent influence of former anesthetic experiences on an individual for whom a second or even a third anesthetization becomes necessary. To the average patient there is nothing more important than the anesthetic because of his fear of losing consciousness. The anesthetist is not infrequently informed that the thought of the anesthetic is more distasteful than is the thought of the operation itself. Most frequently it is the induction of anesthesia that leaves an unfavorable impression on the patient's memory, for it is during the period of

induction of inhalation anesthesia that the fears of the patient have full play and his mental reactions are the greatest. It is this fear of the pending procedure rather than his dread of any attending pain that produces the patient's reluctance to face an ordeal of which such vividly unpleasant recollections remain.

The apprehensive and frightened child, who makes up a large class of patients for whom anesthesia and surgery become necessary, certainly deserves the benefit of analgesics and hypnotics. The psychic damage of fear is never more pronounced than in these patients. Carefully premedicated children show better conduct during induction and maintenance of anesthesia than those denied such medication. The vigorous child will tolerate proportionally a higher dosage than the average adult. The physical and mental condition of the child on entering the operating room, the care and skill in administering the anesthetic, the duration and severity of the operation are all points to be considered just as in adult anesthesia.

The degree of apprehension in individuals varies and the character of outward manifestation is somewhat as variable. Those who suffer the most keenly are not the patients who exhibit the greatest outward evidence of apprehension and nervousness. This is evidenced during the course of the anesthetic. The patient who comes to surgery with outward signs of fear and nervousness but who responds satisfactorily to reassurance and goes into the anesthesia quietly does not cause the anesthetist the concern that does the individual who comes to operation pale, tight-lipped, apparently calm, but with rapid pulse, for this patient presents a picture that presages a stormy induction and a not so smooth anesthesia.

In order that the purposes of premedication may not be thwarted, attention to many details is necessary. Too much stress cannot be placed on assurance as an aid to drug therapy in eliminating psychic fear attendant on procedures of anesthesia and surgery. From the moment a patient enters the hospital door, he should receive courteous consideration from every person with whom he comes in contact. In many instances the object of sedation is defeated because of untactful conversation on the part of friends or attendants. It is essential to have the cooperation of the nursing staff and attendant personnel in an effort to facilitate the ordeal for the patient.

A good night's rest in the hospital preceding the day of the operation is invaluable. Except in the case of an emergency, no surgical patient deserves the denial of twenty-four or forty-eight hours' hospitalization, which provides him an opportunity to familiarize himself with his environment and attending personnel as well as assures him a thorough physical check-up. It also affords those of the hospital personnel who are to be associated with him an opportunity to inspire confidence and relieve his nervous apprehension to some degree. A hypnotic drug may be necessary to insure sleep during this time and may be regarded as a part of the preliminary medication.

Guedel states that the difference in resistance to anesthesia is largely a difference in the metabolic state of the patient.[3] The basal metabolic rate of an individual is of great importance in anesthesia because it represents the degree of oxygen demand and reflex irritability. The reflex irritability level and the rate of oxygen consumption together with the nature of the operation govern the preanesthetic preparation of the patient as well as selection of the anesthetic agent.[3] A patient

ideally prepared for anesthesia is one in whom the metabolic rate approaches as nearly as possible a figure that is normal for the patient. Of the list of known drugs that are of value as preanesthetic medicants many are metabolic depressants in varying degrees. The bringing of metabolism to a normal level requires a knowledge of the state of basal rate before anesthesia and of the existing factors that may influence it. Knowledge of the action of the drugs and of the nature, time, and duration of their produced effects is necessary for rational selection by the prescriber. Since it is not always practical nor even possible to use clinical tests to determine the state of metabolism before operation, observation and experience are, therefore, more dependable in making routine evaluations.

There are many factors which may possibly influence the metabolic state of a preoperative patient. Among those conditions that may play a prominent and consistent part in controlling it, age, fever, pain and emotional excitement may be mentioned as the most common.

The age of an individual markedly influences his metabolic state. Noting the metabolic rates as Guedel has represented them in a graph,[3] one sees a sharp curve upward from birth to the age of one year, following which there is a mild increase until the fourth and fifth years. A moderate swing downward then occurs until the age of puberty is reached, at which time there is again a sharp upward swing which almost reaches the maximal six year peak. At the age of twenty it has gradually dropped to a point level with that of one year. From this age to the age of eighty years there is a gradual decline in the rate toward that of birth. This curve brings out the importance of considering age in preanesthetic medication and explains why children and adolescents tolerate relatively large doses of hypnotics and analgesics and why the aged are most often overdosed.

The probable increase in metabolic rate for every degree of fever present is estimated at approximately seven and one-half per cent. Metabolic increase due to fever is, within itself, constant, but its activity enhances the activity of the other factors that are known to influence a rise in metabolism. An individual with fever is more susceptible to the influence of pain than would be the same individual with a normal temperature.[3]

Pain exerts a substantial influence on metabolism in direct ratio to its severity and the irritability of the nervous system. Pain is relative and becomes more acute as the metabolic rate is elevated. The degree is not measurable but it adds definitely to the metabolic elevation produced by the other factors.[3]

Emotional activity is probably the most frequent factor in producing a temporary preanesthetic increase in metabolism and reflex irritability. Metabolism and reflex irritability are greatly aggravated by fear, and fear is the kind of emotional excitement that one most frequently encounters in patients who are to undergo surgery. There is an adjustment of the bodily functions to meet the apprehended event actuated possibly by the secretion of adrenalin, thyrotoxin, or sympathetic stimulation such as often occurs with such secretion. While the injection of adrenalin experimentally produces a definite but transient effect on the metabolism, it is unquestionably true that in the nervous, apprehensive patient the effect, whatever the mechanism of its production, is sustained and definite.[1]

These four factors affect the metabolism individually and collectively. Their

effects are added one upon the other, and each increases the effect of the other. There may be pain without the presence of any of the other factors, in which case the metabolic elevation will be small. The presence of emotional excitement alone will produce an increase. If these or any other two factors are active together, their combined metabolic elevations will be greater than the sum of their individual actions. Emotional excitement increases sensitivity to pain, and the pain increases the emotional activity. The hyperthyroid patient suffers pain more acutely than does the hypothyroid. Thus with both pain and emotional activity increased in the hyperthyroid patient, elevation of the metabolic rate by these three factors is considerably greater than the summation of each individual factor.[3]

Reduced metabolism is regarded as a protective measure to the patient. The curve of reflex irritability parallels the curve of metabolism; the amount of an anesthetic agent required to produce a given depth of anesthesia will increase or decrease in direct ratio with an increase or decrease in metabolism.[3] A normal metabolism is desirable in order to decrease the amount of the anesthetic drug necessary to give. An estimation of the factors that cause a deviation in the basal metabolic rate will yield indispensable evidence which will be of inestimable value in judging the correct preanesthetic dosage for each individual. With the use of the less potent agents, such as nitrous oxide and ethylene, without such metabolic reduction, it is frequently impossible to maintain surgical anesthesia without anoxemia. When the more potent agents, such as ether and cyclopropane, are used, supplementary depression with preanesthetic sedation permits less dangerous concentration of the anesthetic gas and thereby increases the margin of safety for the patient.

During the last few years there has been an enormous increase in the number of drugs used for preanesthetic medication, and there is a great difference of opinion among anesthetists as to which premedicant is the most effective. Due to the fact that there is a great variation in the effect that a given drug in a given dosage will produce in different individuals and also due to the fact that there is a wide variation of opinion as to what constitutes a desirable effect, the choice of a drug or combination of drugs for preanesthetic medication is largely a matter of personal selection by the prescriber.

Barbituric acid derivatives in depressant doses have been found, experimentally, to protect against the convulsant effects of cocaine and its derivatives caused by overdosage or sensitivity. Clinically it is believed that they also diminish the incidence of mild "procaine reaction."[1]

Peripheral vasoconstrictors such as ephedrine are used to counteract and prevent severe circulatory depression anticipated with some agents and techniques.[1]

The conception of utilizing antagonistic preanesthetic drugs has been largely discredited. The most notable example was that atropine effectively counteracted the respiratory depressant effects of the opiates.[1] The use of atropine in combination with morphine is based on the tradition that still maintains with many, that being the physiologic antagonist of morphine, it provides a safety factor. The development of preanesthetic drugs for particular specific protection must depend on further acquisition of knowledge regarding the effects of the anesthetic agents and on further clinical experi-

ence as to the extent to which those effects if disadvantageous can be prevented or interrupted by non-volatile drugs given preoperatively.[1]

No preanesthetic medicant has had a longer history than the opiates. They also exhibit an efficiency over and above all other drugs used for preanesthetic medication. When used properly, they produce psychic sedation and depress metabolism without resulting impairment of physiologic balance of circulation, respiration, or disturbance of bodily compensatory mechanism. Opium contains two distinct groups of alkaloids, namely: the phenanthrene and isoquinline. The most important in preanesthetic use is the phenanthrene group which includes morphine, codeine, and heroin. Morphine is decidedly the strongest hypnotic and analgesic member of this group and produces a reduction in metabolism. This last action is specific, and in this regard morphine exceeds any other drug used in preparation of surgical patients.[1] An appreciation of the agents that control the metabolism of the patient offers the only foundation for the intelligent administration of morphine for preanesthetic use. Dosage of the drug should be individualized and should be in keeping with the factors that modify the metabolism of the individual. Not only does morphine diminish the preoperative strain for the patient, but it prevents to some extent damage to the central nervous system. Morphine may be administered either subcutaneously, intramuscularly, or intravenously. It should be given long enough before operation so that its maximum effect is taking place at the time the patient arrives in the operating room. Waters found that maximum respiratory and circulatory changes occur in one and a half to two hours and desirable sedation and analgesia are maximum at that time following subcutaneous or intramuscular injection of morphine alone or in combination with either scopolamine or atropine.[4] If the injection is made intravenously, the maximum effect usually occurs within one-third of this time. Experimental and clinical studies indicate that the duration of the effect of morphine given intravenously is almost as long as that following the subcutaneous injection,[5] although the effect after intravenous injection is more pronounced at first. The intravenous method is especially advantageous in emergencies. The drug should be administered in plenty of time before the operation in order to get the full physiological effect before the induction of inhalation anesthesia as it is highly desirable for the safety of the patient that these two do not coincide. It is safer for the patient, and more satisfactory analgesic effect is obtained when the doses are given fractionally. When the smaller doses are used, there are less distressing by-effects than with the use of the one larger dose. If ⅓ or ⅜ grain of morphine is indicated, one-third of the estimated amount is administered two hours before induction of anesthesia, another third is given 45 minutes later, and the last dose is injected 45 minutes following the second dose. If scopolamine or atropine is used in combination with the morphine, it is likewise given in broken doses. In this way the sleepy, indifferent state of the patient is prolonged, full effects of the drugs are insured, and more accurate dosage can be estimated from observation of the action of the first dose. With the use of morphine and scopolamine in combination there seems to be a balancing effect of one drug against the other as regards respiration while at the same time there is an actual additive effect in the direction of anesthesia. With morphine and scopolamine properly balanced, metabolic rate is lowered and anesthesia is made easier

for both the patient and the anesthetist; on the other hand, when scopolamine is given in doses overbalancing the morphine, the action of the scopolamine overrides the depressant effect of the morphine and increases the metabolic rate, and anesthesia is then made more difficult. Atropine has not been found a useful or effective substitute for scopolamine in preanesthetic medication. Morphine has, however, certain effects which are not always desirable. An occasional patient will show an idiosyncrasy to morphine which is evidenced by persistent and prolonged nausea and vomiting. A few are stimulated and some show depression of the respiratory centers that not infrequently becomes a matter of much concern to the anesthetist. Marked respiratory and circulatory depression are usually caused by overdosage, for which the most effective treatment is the administration of oxygen alone or in combination with a small percentage of carbon dioxide, which will insure the tissues sufficient oxygenation until the toxic effects of the drug can be controlled. Artificial respiration may be necessary to assist in eliminating asphyxia. Respiratory stimulants as well as fluids and elimination constitute effective treatment in stubborn cases.

While codeine has much to recommend it over morphine as a central respiratory depressant, it is not sufficiently powerful to justify its use clinically for preanesthetic hypnosis.

There are several synthetic substitutes and opium derivatives such as dilaudid and pantapon which are widely used. While enthusiastic claims as to their merits as preanesthetic drugs are made by many, well controlled clinical or laboratory investigations have not yet proved conclusively that they should replace morphine in this respect.

Dilaudid was first used in this country by Alvarez in 1932.[7] Dilaudid is commonly used in the place of morphine and has powerful analgesic properties but little hypnotic action. It is claimed by some that it has fewer by-effects than morphine, such as nausea, constipation, and euphoria. Dilaudid acts more rapidly but over a shorter period of time than morphine.

Pantapon is described as representing total opium in purified injectible form;[8] that is, it contains the alkaloids of opium freed from impurities and other ballast. According to "New and Non-Official Remedies" (Roche), pantapon is "a mixture of the hydrochlorides of the alkaloids of opium in the proportion in which they exist in Smyrna opium." Pantapon is widely used as a preanesthetic medicant in the place of morphine and is claimed by some to have clinical advantages over morphine. This drug supposedly depresses the respiratory center less in relation to its narcotic activity, produces nausea and vomiting less readily and less frequently, has less prolonged action, and is less euphoric than morphine.

Scopolamine or hyoscine, which belongs to the belladonna group, is said to synergize with morphine and to enhance its depressant action, especially on the cortex. It is chemically related to atropine and has a similar effect on the autonomic nervous system. Scopolamine is sedative in all doses and reduces metabolism only by reducing emotional excitement. By its parasympathetic action it inhibits secretions, and in therapeutic doses it inhibits the secretion of saliva more actively than does morphine. It is effective in 15 to 20 minutes when given subcutaneously, the effect lasting for several hours. Scopolamine proves its value by aiding rather than antagonizing the action of

morphine, by decreasing muscular irritability, and by presenting a greater margin of safety than the barbiturates in that it does not depress the blood pressure. The response of man to scopolamine is variable although the usual reaction with therapeutic doses is one of sedation. The therapeutic dose of scopolamine varies from 1/100 grain to 1/300 grain, and smaller doses than this are often not effective even in children. The untoward reactions from scopolamine are manifested by a flushed face, pallor around the mouth, tachycardia, and rarely uncontrollable excitement. The drug is thought to deteriorate rapidly, and toxic reactions most often follow the use of scopolamine that is more than a year old.[1] The use of ampules to market the drug has reduced incidence of unfavorable reactions to a minimum. The use of tablets containing this drug carries an element of danger. Apomorphine in less than emetic doses from 1/40 grain to 1/30 grain has been found a useful and satisfactory antidote to the unfavorable reaction occasionally observed following therapeutic doses of scopolamine.[1]

Atropine, also one of the belladonna group, was introduced as an adjunct to chloroform anesthesia, in order to prevent paralyzing the peripheral endings of the vagi. With ether anesthesia it is advocated on the basis of preventing "mucus inundation" caused by the irritant action of ether vapor on bronchial mucus membranes, and/or suppressing salivation.[6] With modern gas-oxygen anesthesia and the use of the rebreathing technique these reasons for the use of atropine no longer exist. Some physiologists condemn the practice of interfering with the protective function of bronchial secretion as long as satisfactory cough reflex is present to prevent formation of mucus plugs with the danger of resultant atelectasis.[6] After mucus has once been stimulated, it is not advisable to give atropine or scopolamine; for, although any further secretion is checked, the mucus already present becomes more tenacious and troublesome. Atropine is a direct metabolic stimulant and the physiologic antagonist of morphine, the sedation of which is of utmost value in producing and maintaining efficient and safe anesthesia. The stimulating effect of atropine upon the respiration is a definite disadvantage, particularly in abdominal surgery where the increased diaphragmatic activity interferes with intestinal activity, resulting in the necessity for producing too deep anesthesia.

The action of the ever-increasing series of barbituric acid derivatives is so varied in pharmacological and biochemical respects that it is practically impossible to consider them other than separately. Barbital, the parent drug, has been widely replaced by its more recently discovered derivatives. Although in general the different barbitals have similar effects, their true values as premedicants vary markedly; also numerous substituted derivatives have in general the same actions and in a therapeutic sense may also be considered as different preparations or forms of one substance. They differ in dosage, rapidity of action, and somewhat in the breadth of the therapeutic zone.[9] The barbiturates produce hypnosis by depressing the central nervous system, particularly the higher cerebral centers. Ordinary and hypnotic doses are analgesic to a mild degree but if given in the presence of severe pain may cause excitement. The response to the barbitals is rather variable and quite markedly so in some individuals. Some writers claim excellent, others unfavorable, clinical results with the same drug. Moreover, the experimental criteria for the barbiturates formulated with animals is often contradic-

tory and not applicable clinically since the variability among different species is marked.[1]

Basal metabolism is not significantly changed even by full hypnotic doses of barbiturates;[9] however there is a marked decrease in metabolism with the use of doses approaching serious depression of the central nervous system. The use of the barbituric acid derivatives in conjunction with anesthesia is a definite accession to anesthesia technique. They are useful to produce sleep the night preceding operation, to tranquilize the patient, to allay nervousness and apprehension, and finally to assume a part of the burden of actual induction and conduct of anesthesia. They also lessen the toxic manifestations following the injection of procaine hydrochloride.

The barbiturates are administered subcutaneously, intravenously, rectally, or orally. The latter method, because of its greater safety, is more satisfactory for preanesthetic medication. A choice of the dose of a barbiturate involves chiefly a consideration of the duration of its effects and toxicity. The desired sedative effect cannot be assured but estimated only. The physical condition of the patient, his weight and age must be considered. Manifestations from overdoses of the barbiturates are variable. The most common phenomena are respiratory and circulatory depression accompanied by deep and prolonged sleep. The more acute cases show marked fall in blood pressure and temperature, with sometimes paralysis of respiration. There is danger of pulmonary edema if the depression is prolonged and great. Treatment should consist in evacuation, administration of oxygen and carbon dioxide, artificial respiration, and stimulating drugs. Caffeine, metrazol, and picrotoxin are recommended as being the most effective.

Paraldehyde is formed by the linking together of three molecules of aldehyde. Its chief action is hypnotic, but it also acts as a sedative. It is commonly stated to be the safest hypnotic known, and there is a wide margin of safety between the therapeutic and the toxic dose. This drug has no deleterious effects on the circulation, respiration, blood pressure, or metabolism. It is excreted unchanged largely through the lungs but partly by the skin and kidneys. While paraldehyde may be administered intravenously, orally, or by rectum, as a preliminary hypnotic rectal administration is preferable: and the full effect of the drug may be anticipated within 20 to 45 minutes. The effect of intravenous injection is immediate but transient. The preliminary dosage of paraldehyde is from four to eight drams, depending somewhat upon body weight (one dram to each fifteen pounds), but more on the degree of nervous excitability which must be overcome. The patient remains oblivious to the administration of the anesthetic; and induction, by any of the usual methods, is singularly easy and rapid owing to the complete absence of resistance or excitement. The maintenance of anesthesia becomes a simple matter and a surprisingly small quantity of the inhalation anesthesia is required. This drug is more consistent in its action than are the barbitals. Paraldehyde has been recommended particularly for chronic alcoholics and patients with decreased vital capacity. Its principal disadvantages are its long action, disagreeable taste, and fusel-oil odor of the breath persisting over a day.[9] Untoward reactions are reported only from excessive doses. Treatment consists of oxygenation and artificial respiration until the toxic effects of the drug are overcome.

While ephedrine serves only one role in preanesthetic medication, that role

is an important one. It helps to counteract the specific circulatory depression following spinal and tribromethanol anesthesia.

The anesthetic to be employed and the technique to be used has a direct bearing on the selection and amount of drugs used for preparation. With the relatively more potent agents less preliminary medication is desirable. What would be considered more than an adequate dose of a drug or a combination of drugs given preliminary to the use of cyclopropane oftentimes proves an inadequate dosage for nitrous oxide. The use of special techniques is often made easier by suitable premedication. Light surgical anesthesia with hyperpnea facilitates the blind introduction of an endotracheal airway through the nostril. If the respiratory center has been much depressed with non-volatile drugs, this desirable condition will not be so readily obtained.[1]

Summary

When there are so many different drugs being offered for a given use it may be assumed, with a fair element of probability, that none of the drugs are entirely satisfactory.[10] This is true of the drugs offered today for preanesthetic medication. It is not advisable to standardize a definite drug or a combination of drugs for preanesthetic preparation and choose this routine in each case. Such premedication cannot consistently give safe and satisfactory results.

There is a definite need for consideration of all factors involved in the subject of premedication. This cannot be done by any set rule or table of dosages for any drug or combination of drugs.

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STATE ORGANIZATIONS FORMED

ILLINOIS

During the worst blizzard which Chicago had experienced in many years, seventy-five anesthetists representing hospitals throughout the state of Illinois attended the organization meeting, which was held at St. Joseph's Hospital, Chicago, on February 1st. The group was welcomed by Sister Delphine of the Sisters of St. Joseph Hospital. Dr. Austin A. Hayden, Chief of Staff, and always a loyal friend of the nurse anesthetists, extended greetings and best wishes.

The Association voted unanimously to make application for affiliation with the National Association of Nurse Anesthetists. Following the business meeting refreshments were served.

Officers elected for the coming year:

President
Mabel Nichol
St. Joseph Hospital, Chicago

First Vice-President
Jean Roth
Mercy Hospital, Chicago

Second Vice-President
Ann E. Kedas
Michael Reese Hospital, Chicago

**Secretary*
Ora Lee Hartley

Treasurer
Ann Priester
West Suburban Hospital, Oak Park

Historian
Nell[illegible] Vincent
[illegible] Hospital, Evanston

MABEL NICHOL
President

Trustees
Mae B. Cameron
Ravenswood Hospital, Chicago

Sister Rudolpha
St. John's Hospital, Springfield

Anna Willenborg
18 East Division St., Chicago

WASHINGTON

The organization meeting of the Washington Association of Nurse Anesthetists was held at the Olympic Hotel, Seattle, on February 20th, in conjunction with the Western Hospital Association. The attendance of thirty-seven included anesthetists from Spokane, Tacoma, Aberdeen, Bellingham, Long-

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* Miss Hartley later resigned because of leaving the state, and Miss Gladys H. Hoffman, Englewood Hospital, 6001 Green Street, Chicago, was appointed to fill the vacancy.

view, Everett and Seattle. Miss Elsa Koski, Tacoma General Hospital, acted as Chairman, and the following officers were elected:

President
June Roberts
Sacred Heart Hospital, Spokane

Vice-President
Emily Pursell
10 S. 9th Ave., Yakima

Secretary
Mildred Peterson
705 Broadway, Seattle

Treasurer
Esther Rudkin
Deaconess Hospital, Spokane

Historian
Clara Trapp
Sacred Heart Hospital, Spokane

Trustees
Martha Lee
Puyallup Hospital, Puyallup

Alice Scott
518 Rice St., Aberdeen

Mary Leonard
Medical Arts Bldg., Spokane

In order for the anesthetists to be able to attend meetings more often the state was organized into the Eastern and Western Divisions. Frequent contact will be made between the secretaries of the two sections and minutes of every meeting will be exchanged. It was voted unanimously to apply for affiliation with the National Association of Nurse Anesthetists.

Regular monthly meetings will be held in Spokane, which is the largest city in the Eastern Division, and in either Tacoma, Seattle or Everett, which are the largest cities in the Western Division.

A meeting was held at Sacred Heart Hospital, Spokane, on March 13th, at which an active discussion took place relative to the plans for future development of the state association.

ACTIVITIES OF STATE ORGANIZATIONS

CALIFORNIA

The annual meeting of the California Association of Nurse Anesthetists was held on March 7, 1939, at the St. Francis Hospital, San Francisco. Thirty-one of the total membership of ninety-five active members were present.

After a discussion of cases of especial interest it was suggested that all members of the Association avail themselves of the opportunity to inspect the medical exhibits at the Golden Gate International Exposition.

A vote of thanks was tendered the outgoing officers for their splendid work, and the following were elected for the coming year:

President
Martha Bickel
Franklin Hospital, San Francisco

Vice-President
Mary Johnson
1904 Franklin St., Oakland

Program Committee
Myra Belle Quarles
Irene L. Krekeler
Nan Snodgrass

Secretary-Treasurer
Marian L. Lagan
5 Prado St., San Francisco

Trustees
Three years Helen Kulchar
Two years Margaret McCoppin
One year Gladys M. Bolton

Membership Committee
Bertha M. Clark
May Malamphy
Eva Wilson

GEORGIA

Since the organization meeting of the Georgia anesthetists, which was held on August 13, 1938, at St. Joseph's Infirmary, Atlanta, Ga., the membership has doubled itself. The officers elected at the organization meeting were as follows:

President	Mrs. Rosalie McDonald Emory University Hospital, Emory University, Ga.
Vice-President	Rhea Carnes Archbold Memorial Hospital, Thomasville, Ga.
Secretary-Treasurer	Caroline E. Hohenschutz 144 Ponce de Leon Ave., N. E., Atlanta, Ga.
Trustees:	
Two years	Myrtle Rogers Georgia Baptist Hospital, Atlanta, Ga.
	Mrs. Ruby Ridley 1055 Rosewood Drive, N.E., Atlanta, Ga.
One year	Mrs. T. H. Burns Route 2, Decatur, Ga.

MICHIGAN

Thirty-five members of the Michigan Association met at St. Mary's Hospital, Detroit, on March 11th.

The paper on "Analeptics" which is published in this issue was read by Lillian G. Baird, University of Michigan Hospital, Ann Arbor. Mrs. Gertrude Myers of St. Mary's Hospital gave a talk on "Ethyl Choride" in which was included a report of its use since 1923 at St. Mary's Hospital. Following an interesting discussion refreshments were served by the anesthesia staff of St. Mary's Hospital.

MINNESOTA

The Minnesota Association of Nurse Anesthetists sponsored a course of lectures of five two-hour periods, starting February 1st and repeated on March 6th, which were held in the lecture room of the Minneapolis General Hospital and were given by Dr. Ralph Knight. Alice Anderson and her staff at the Minneapolis General Hospital took care of the arrangements. The lectures were very well attended and the hospital superintendents cooperated by making it possible for their anesthetists to attend. Anesthetists from the surrounding states were invited.

Minnesota anesthetists are again reminded of the circulating library. Promptness in returning books will be greatly appreciated. All matters pertaining to the library should be referred to Ruth Walthers, Minneapolis General Hospital.

Miss Hazel J. Peterson, of Fairview Hospital, Minneapolis, Minn., was appointed Chairman of the Program Committee for the annual meeting of the National Association of Nurse Anesthetists, which will be held in Toronto, Canada, September 26-29, 1939.

SEE PAGE 121 FOR ANNOUNCEMENT OF ANNUAL MEETING IN MAY.

OHIO

The sixth annual meeting of the Ohio Nurse Anesthetists Association was held in conjunction with the Ohio Hospital Association, at the Deshler-Wallick Hotel, Columbus, Ohio, on Wednesday, April 12, 1939. A very interesting program was carried out, as follows:

"Endotracheal Anesthesia"
Naomi Butler
Cincinnati General Hospital, Cincinnati, Ohio

"Obstetrical Anesthesia and Analgesia"
Frances Kocklauner
University Hospitals of Cleveland

"Why Buy What"
Robert M. Porter
Assistant Administrator, City Hospital of Akron, Ohio

"Anesthesia in Children"
Dorothy McGilliard
Children's Hospital, Cincinnati, Ohio

"Clinical Application of Cyclopropane, Helium and Vinethene"
Sister M. Benignus Leahy
Mercy Hospital, Hamilton, Ohio

At the annual banquet on Wednesday evening Miss Sauers and Miss Kocklauner acted as hostesses.

The following officers were elected for the year:

President
Kay Sheehan
Charity Hospital, Cleveland

First Vice-President
Myrn E. Momeyer
St. Luke's Hospital, Cleveland

Second Vice-President
Agnes A. Wass
Woman's Hospital, Cleveland

Secretary-Treasurer
Mildred Sauers
City Hospital, Cleveland

Trustees
Violet Campbell
St. Elizabeth Hosp., Youngstown

Alice L. Barth
Youngstown Hospital, N. S. Unit,
Youngstown

KAY SHEEHAN
President

OREGON

The second annual meeting of the Oregon Association of Nurse Anesthetists was held at St. Vincent's Hospital, Portland, Oregon, on December 19, 1938. The report given by the President reviewed many interesting events of the previous year, and the Secretary reported forty-eight active and five associate members.

Miss Mabel McElligott, President; Miss Anne Feser, Secretary; Mrs. Clara McCorkle, Mrs. Jessie Fletcher and Miss Lillian McDonald attended the organization banquet of the Washington Association of Nurse Anesthetists held in Seattle on February 19th.

Plans are now under way to bring about more frequent contact with the members which would keep them in touch with the activities of the organization. A monthly mimeographed bulletin is being considered and Mrs. Josephine Bunch has been appointed Chairman of the committee to study this activity. Other committees are as follows:

Membership and Finance
Margaret H. Love, Chairman
Mary K. Dimig
Clara McCorkle

Program and Education
Elizabeth D. Johnson, Chairman
Aimee L. Doerr
Muriel Herin

Public Relations and Revisions
Alice F. Gonier, Chairman
Margret Giddings
Marie E. Floren

Sick Committee
Anne Dempsey, Chairman
Ruth Pobochenko
Mrs. H. Svenson

The following officers were elected for the year:

President
Mabel McElligott
4705 N. E. Mallory Ave., Portland

First Vice-President
Keturah M. Wilmot
2026 S. E. Elliott Ave., Portland

Second Vice-President
Merwyn Darby
811 N. W. 20th Ave., Portland

Secretary
Anne Feser
Medical Dental Bldg., Portland

**Treasurer*
Jeanette Byford

Trustee
Elizabeth D. Johnson

Board of Trustees

5 years	Elizabeth D. Johnson
4 years	Aimee L. Doerr
3 years	Sister Agnes de Boheme
2 years	Hazel I. Wilhelm
1 year	Sister Ottilia

PENNSYLVANIA

The Pennsylvania Association of Nurse Anesthetists held their eighth annual meeting on April 26 and 27, 1939, at the Bellevue-Stratford Hotel, Philadelphia, Pa. It was impossible to publish a report of the meeting in this issue, but the following took part in the program:

Address of Welcome
Rose G. Donovan
President Pennsylvania Association of Nurse Anesthetists

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* Miss Byford later resigned because of leaving the state, and Margaret H. Love, 3130 N. E. 19th Street, Portland, was appointed to fill the vacancy.

Greetings
John N. Hatfield
President, Hospital Association of Pennsylvania

Greetings
Miriam G. Shupp
President, National Association of Nurse Anesthetists

"Lingual Death Zones" illustrated by slides
Chevalier Jackson, M.D.
Honorary Professor of Bronchoesophagology, Temple University School of Medicine, Philadelphia

"Anesthesia in Brain Surgery"
Francis C. Grant, M.D.
Professor of Neurosurgery, University of Pennsylvania School of Medicine

"Some Salient Aspects of Cyclopropane Anesthesia"
Robert L. Patterson, M.D.
Hartford Hospital, Hartford, Conn.

"Psychology in Relation to Anesthesia"
Elizabeth Davis
Allentown Hospital, Allentown, Pa.

"Plastic Surgery" illustrated by slides
George M. Dorrance, M.D.
Professor of Maxillofacial Surgery, Thomas Evans Institute, University of Pennsylvania; Surgeon, American Oncologic Hospital, Philadelphia

"Helium, Compressed Air and Cyclopropane"
Frances Hess
Directress of Anesthesia, Long Island College Hospital, Brooklyn, N. Y.

Round Table discussion
Hilda R. Salomon
Jewish Hospital, Philadelphia

"Surgery for Relief of Tuberculosis of the Lungs"
Moses Behrend, M.D.
Chief of Division of Thoracic Surgery, Philadelphia Gen. Hospital

"Endotracheal Anesthesia"
George J. Thomas, M.D.
Instructor of Anesthesia, University of Pittsburgh Medical School

"Anesthesia and Analgesia in Labor"
Norris W. Vaux, M.D.
Professor of Obstetrics, Jefferson Medical College, Philadelphia

"Sodium Evipal as a Rectal Basal Anesthetic"
Edwina M. Irons
Protestant Episcopal Hospital, Philadelphia

Discussion
Edward T. Crossan, M.D.
Chief Surgeon, Protestant Episcopal Hospital, Philadelphia

"Anoxemia and Anesthesia"
Howard H. Bradshaw, M.D.
Director of Anesthesia, Jefferson Medical College Hospital, Philadelphia

At the first day's session Grace Williams, of Allegheny General Hospital, Pittsburgh, presided, and Katherine Dickinson, of Lankenau Hospital, Philadelphia, at the afternoon session on Thursday. A luncheon was held at the Warwick Hotel at which the delegates were guests of District No. 1. The banquet of the Hospital Association was held on Thursday evening at the Bellevue-Stratford Hotel.

CORRECTION

On page 53 of the February, 1939, issue of the Bulletin, the name of Miss Nancy Ingram, Philadelphia General Hospital, Philadelphia, was incorrectly given as Chairman of the Program Committee for the Pennsylvania annual meeting, instead of Miss Edwina Irons, Episcopal Hospital, Philadelphia.

MID-SOUTH POST GRADUATE NURSE ANESTHETISTS' ASSEMBLY

The fifth annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, complete program for which was published in the February Bulletin, was very well attended and the large number of instructive papers, part of which appear in this issue, called forth much active discussion.

The following officers were elected for the year:

President
Martha Brown
Davis Hospital, Pine Bluff, Ark.

Vice-President
Gilberta H. Snow
Camden, Ark.

Vice-President
Elizabeth N. Wates
Mississippi State Sanatorium,
Jackson, Miss.

Vice-President
Louise Green Halford
Meharry Medical College,
Nashville, Tenn.

Executive Secretary
Alice Maurine Sims
704 Goodwyn Institute,
Memphis, Tenn.

ANESTHETISTS MEET WITH THE SOUTHEASTERN HOSPITAL CONFERENCE

At a meeting of the anesthetists from the states which comprise the Southeastern Hospital Conference, held in Jacksonville, Florida on April 13, 14 and 15, 1939, the organization of the Southeastern Assembly of Nurse Anesthetists was effected. The states officially represented in this Assembly at the present time are Alabama, Georgia and Florida. Mississippi and Louisiana were invited to join the Assembly, but Louisiana is not as yet organized, and Mississippi was forced to wait until after the annual state meeting, which will be held in May, to give a decision. At the meeting the following officers were elected:

MARTHA BROWN
President

GILBERTA H. SNOW
Vice-President
Arkansas

LOUISE GREEN
HALFORD
Vice-President
Tennessee

OFFICERS
Mid-South
Post Graduate
Nurse
Anesthetists'
Assembly

ELIZABETH WATES
Vice-President
Mississippi

President
Mrs. Rosalie McDonald
Emory University Hospital,
Emory University, Ga.

Secretary-Treasurer
Mrs. Ida Tedford Ellis,
Orange County Hospital,
Orlando, Fla.

The anesthetists' group agreed to follow the plan of the Southeastern Hospital Conference as to the election of officers, which is to automatically draw officers from the state in which the next annual meeting of the Conference is to be held; such officers to serve the current year. It was advocated that the several states comprising the Assembly hold annual business meetings separately during the convention of the Southeastern Nurse Anesthetists' Assembly.

Financial Arrangements

The Assembly will collect $1.00 registration fee at the annual convention, and the states will contribute to the Assembly 50 per cent of the state dues of each member per year.

Miss Agatha C. Hodgins, Honorary President of the National Association of Nurse Anesthetists, and Miss Helen Lamb, Chairman of the Educational Committee of the National Association, were guest speakers. The program was as follows:

Thursday morning, April 13

GENERAL SESSION

Presiding
Mary Blande Parks, Druid City Hospital, Tuscaloosa, Ala.

Invocation
The Reverend Father J. S. Walsh, Jacksonville, Fla.

Address of Welcome
Alpha Schier, Duval County Hospital, Jacksonville, Fla.

Response
Verna M. Rice, Mobile, Ala.

Greetings from the American Hospital Ass'n
G. Harvey Agnew, M.D., President, Toronto, Canada

"Helium: Its Use in Gas Anesthesia"
Anna Traber, Drennen Clinic, Birmingham, Ala.

"Viewpoints Concerning Anesthetists as seen by Hospital Administrators"
Robert S. Hudgens
Emory University Hospital, Emory University, Ga.

Thursday afternoon

GENERAL SESSION

Presiding
Ida Tedford Ellis, Orange General Hospital, Orlando, Fla.

"Surgery in Diabetics"
Karl Hanson, M.D., Jacksonville, Fla.

"Pentothal Sodium: Intravenous Use in Children"
Anne Beddow, Norwood Hospital, Birmingham, Ala.

"Spinal Anesthesia in the Small Hospital"
J. M. Forney, M.D., Tuscaloosa, Ala.

"The Anesthetist in the Small Hospital"
Mrs. Sam Owen
George C. Hixon Memorial Hospital, Electric Mills, Miss.

Business Meetings of State Associations

Friday morning, April 14

Joint Session Southeastern Hospital Conference and Anesthetists
Subject—"Anesthesia"
Speakers—Henry Heddon, M.D.
Methodist Hospital, Memphis, Tenn.
Helen Lamb
Chief Anesthetist, Barnes Hospital, St. Louis, Mo.

Friday afternoon

GENERAL SESSION

Presiding
Mrs. Sam Owen
George C. Hixon Memorial Hospital,
Electric Mills, Miss.

Greetings from the Southeastern Hospital Conference
Fred M. Walker, President
Duval County Hospital, Jacksonville, Fla.

"Cyclopropane Anesthesia: A Report of 2,720 Cases"
Rosalie McDonald
Emory University Hospital, Emory University, Ga.

"Role of the Nurse Anesthetist in Spinal Anesthesia"
Ruby Ridley
Steiner Clinic, Atlanta, Ga.

"The Measured Administration of Anesthetic and Auxiliary Gases"
Helen Lamb
Barnes Hospital, St. Louis, Mo.

Joint Meeting of the Executive Committees of State Associations
Presiding—Rosalie McDonald, President
Georgia Association of Nurse Anesthetists

7:00 P.M.—Southeastern Hospital Conference Banquet and Dance
Roosevelt Hotel

COMING MEETINGS

MINNESOTA

The annual meeting of the Minnesota Association will be held on Friday, May 26, 1939, at the St. Paul Hotel, St. Paul, Minnesota, in conjunction with the Minnesota Hospital Association. The Committee has arranged an interesting program. Gertrude Fife of the University Hospitals of Cleveland, Ohio,

will speak on "Anesthesia in Heart Surgery" at the anesthetists' meeting, and at the Minnesota Hospital Association session she will speak on "The Anesthesia Department."

For further information write Miss Julo Slattendale, Secretary, University Hospital, Minneapolis, Minn.; or Miss L. Rose Littel, Chairman Program Committee, Minneapolis General Hospital, Minneapolis, Minn.

PROGRAM

SIXTH ANNUAL MEETING

New York Association of Nurse Anesthetists

HOTEL PENNSYLVANIA, NEW YORK, N. Y.

May 17-19, 1939

Tuesday, May 16th

8:00 P.M. Meeting of the Board of Directors

Wednesday morning, May 17th

9:00 A.M. Registration

10:00 A.M. Joint Meeting of Board of Directors and Chairmen of Committees

Wesnesday afternoon GENERAL SESSION

Conference Room 2, Mezzanine floor

Presiding—Miriam G. Shupp, President, National Association of Nurse Anesthetists

2:00 P.M. Invocation
The Reverend Roelff H. Brooks
St. Thomas Church, New York City

2:15 P.M. Greetings from the Hospital Association of New York
John H. Hayes, President

2:30 P.M. "The Use of Compressed Air and Helium in Anesthesia"
Pauline Lapinski, Long Island College Hospital, Brooklyn, N. Y.

3:00 P.M. "The Heart in Relation to General Anesthesia"
Herbert W. Schmitz, M.D.
Attending Physician, Irvington House, Irvington-on-the-Hudson, N. Y.

3:30 P.M. "Anesthesia in Orthopedics"
George Anopal, M.D., F.A.C.S.
Chief Orthopedic Surgeon, Post-Graduate Medical School and Hospital, New York City

4:00 P.M. Tea — All guests, friends, and members of the Association are cordially invited.

Thursday morning, May 18th

9:00—10:30 A.M. Clinic—New York Hospital
525 East 68th Street, 10th floor

10:30—11:15 A.M. "Anesthesia in Thoracic Surgery"
Cranston W. Holman, M.D.
Associate Surgeon, Thoracic Surgery, New York Hospital
Auditorium—10th floor, F Building

11:15 A.M. "Demonstration Anesthesia Records"
Sara M. Mullin
Anesthetist in charge of Surgery Clinic

Thursday afternoon

Presiding—Verna E. Bean
St. John's Hospital, Brooklyn, N. Y.

2:00 P.M. "Anesthesia in Labor"
James T. Gwathmey, M.D.
Consultant, Post-Graduate Hospital, New York City

2:30 P.M. "Anesthesia from the Standpoint of the Surgeon"
Virginio Minervini, M.D., F.A.C.S.
Chief Surgeon, Yonkers General Hospital, Yonkers, N. Y.

3:30 P.M. Business Meeting
Hazel Blanchard, President, Presiding

Reports:
- President
- Secretary
- Treasurer
- Standing Committees

Appointment of Tellers

New business

Thursday evening

7:00 P.M. Banquet — New York Hospital Association
Ballentine Restaurant
World's Fair Grounds, New York City

Friday morning, May 19th

Presiding — Frances Hess
Long Island College Hospital, Brooklyn, N. Y.

9:30 A.M. "Management of the Nursing Students' Course in Anesthesia"
(with Stereopticon slides)
Dorothy N. Calder,
Yonkers General Hospital, Yonkers, N. Y.

10:30 A.M. "Anesthesia in Oral Surgery"
Georgia Whitman
Dental Anesthetist, New York City

11:00 A.M. "Pneumatology, Anesthesia, Resuscitation and Oxygen Therapy" (stereopticon slides)
F. Paul Ansboro, M.D.
Director of Anesthesia, Kings County Hospital, Brooklyn

Friday afternoon

Presiding—Rosemary F. Bentz, New York City

2:00 P.M. "Anesthesia in Obstetrics"
Flora A. Richardson
Methodist Episcopal Hospital, Brooklyn

2:30 P.M. "Obstetrical Analgesia and Anesthesia"
Jacob Kertzman, Associate Professor,
Fordham Hospital, New York City

3:00 P.M. "Analgesia in Dentistry"
James F. Henegan, D.D.S., F.I.C.A.
New York City

3:30 P.M. Unfinished business
Report of Tellers
Introduction of New Officers

NATIONAL CONVENTION
1939

The seventh annual meeting of the National Association of Nurse Anesthetists will be held in conjunction with the American Hospital Association, in Toronto, Canada, September 26 to 29, inclusive.

Hotel headquarters—King Edward, Toronto.

All questions for the Round Table discussion should be mailed not later than August 15th to Miss Anna Willenborg, Executive Secretary, 18 East Division Street, Chicago, Ill.

All members planning to attend the annual meeting are asked to please inform National headquarters.

Letters have been received from various members asking for information in regard to hospitals at which they could stop to visit the Anesthesia Department on their way to Toronto. Information will be sent upon request and arrangements made through National headquarters for special clinics if possible, if the requests are sufficient in number to warrant such arrangements.

For further information write the Executive Secretary, Anna Willenborg, National Association of Nurse Anesthetists, 18 East Division Street, Chicago, Illinois.

The National Association pin may be purchased at National headquarters, at a price of $1.00 (postage paid), payable with order.

THE ANESTHESIA EXPLOSION HAZARD

Many requests have been received for articles on safeguards against anesthesia explosion hazard. An article was published in Modern Hospital in April, 1936, and a similar article appeared in the National Bulletin of November, 1936. The following, which we think will be of value in this conection, is reprinted from "The Anesthesia Explosion Hazard", published in the November, 1936, issue of the National Bulletin.

The Code deals with types of equipment, building design and precautionary procedure. Needless to say, matters relating to types of equipment, installation of wiring, switches, fixtures and the like, or such protective measures as air conditioning or humidifiers are matters of concern primarily to the hospital administration and department heads. On the other hand, there are numerous precautionary measures which are a matter of daily routine procedure on the part of all surgical personnel.

In the University Hospitals of Cleveland, we have endeavored to periodically instruct all surgical personnel regarding the explosion hazard. This has been done by direct verbal instruction and also by posting in a number of conspicuous places important excerpts from the Code of Safeguards.

It may be of further interest to add that in the University Hospitals we follow the procedure of a complete inspection of every piece of electrical equipment used in surgery, once every three months. This inspection is made by our electrical engineer accompanied by the operating room supervisor. All such equipment as may have concealed electric wiring is tested for condition of insulation for reasons which I have already pointed out.

EXCERPTS FROM THE CODE OF SAFEGUARDS AGAINST ANESTHESIA EXPLOSION HAZARDS

1. CYLINDERS, ETHER CANS, ANESTHESIA MACHINES:
   (a) Kept away from radiators, steam pipes, other sources of heat, possible contact with fire, *electrical equipment,* sparks, et cetera.
   (b) No flame permitted in operating room, anesthetizing rooms or adjacent corridors, where anesthetics are stored or used.
   (c) No lighted cigars, cigarettes or pipes permitted in such places.
2. PROHIBITED IN OPERATING ROOM OR WHERE ANESTHETICS ARE BEING ADMINISTERED:
   (a) Wool blankets.
   (b) Silk or wool outer garments.
   (c) Ether never used for cleaning purposes.
3. ANESTHESIA EQUIPMENT:
   (a) Four ounces water placed in breathing bag before starting anesthesia.
   (b) Breathing tubes and mask flushed with water before starting anesthesia.
   (c) Anesthesia machine flushed immediately with carbon dioxide when anesthetic is discontinued.
   (d) No oil or grease used on anesthesia machine, or on oxygen valves or lines.
4. ROOMS NOT EQUIPPED WITH VAPOR PROOF ELECTRIC SWITCHES:
   (a) No switches operated, plugs inserted or pulled out in presence of anesthesia machine or for ten minutes after its removal from room.

5. WITH USE OF SUCH APPARATUS AS BOVIE UNIT, FULGURATION MACHINE, NERVE FINDER, BONE SAW, X-RAY, MOTOR DRIVEN APPARATUS, OR IN FLUOROSCOPIC ROOM, following technique permissible:

(a) Ether throughout (gas machine removed from room).

(b) Gas-oxygen throughout, with no ether having been given or in the machine.

(c) Gas-oxygen-ether, to induce anesthesia.

When electric apparatus is being used, gas machine removed from room and continue with:

(a) Drop ether

(b) Ether through machine, such as Connell.

(Note:—There must be an interval of ten minutes between the discontinuance of gas-oxygen-ether, and use of above electric apparatus.)

6. CAUTERIES AND SPARK PRODUCING EQUIPMENT SHALL NEVER BE USED IN MOUTH, AROUND HEAD, OR PLEURAL CAVITY, EXCEPTING THE ANESTHETIC BE A NON-INFLAMMABLE TYPE.

7. TRANSPORTING MACHINES TO DISPENSARY, DENTAL CLINIC, ET CETERA:

(a) No ether in machine—to be carried in can separately if needed.

(b) No ether in machine in Dental Clinic unless absolutely necessary.

8. ANESTHETICS ADMINISTERED IN PATIENTS' ROOMS:

(a) No ether to be used, or carried in machine.

If ether is necessary, patient to be brought to surgery.

9. REPORT IMMEDIATELY DEFECTIVE ELECTRICAL EQUIPMENT, CORDS, TERMINALS, ETC.

SURGICAL PERSONNEL ARE REQUIRED TO BE FAMILIAR WITH *ENTIRE CODE*.

BULLETIN OF THE NATIONAL ASSOCIATION OF NURSE ANESTHETISTS

The Bulletin of the National Association of Nurse Anesthetists is published by the National Association of Nurse Anesthetists; Executive, Editorial and Business Offices, 2065 Adelbert Road, Cleveland, Ohio.

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EDITORIAL COMMUNICATIONS

The Bulletin invites concise, original articles on anesthesia. Description of new technics and methods are welcomed. Articles are accepted for publication with the understanding that they are contributed solely to the National Bulletin.

Manuscripts submitted for publication may be sent to Gertrude L. Fife, University Hospitals, Cleveland, Ohio.

The National Association of Nurse Anesthetists does not hold itself responsible for any statements or opinions expressed by any contributor in any article published in its columns.

Manuscripts. — Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. References should be placed at the end of the article and should conform to the following style: viz., name of author, title of article, and name of periodical with volume, page, and year.

Illustrations accompanying manuscripts should be numbered, provided with suitable legends, and marked on margin or back with the author's name. Authors should indicate on the manuscript the approximate position of text figures.

Illustrations — A reasonable number of half-tones will be reproduced free of cost to the author, but special arrangements must be made with the Chairman of the Publishing Committee for elaborate tables or extra illustrations.

Reprints. — Fifty or more reprints may be obtained at a nominal cost if ordered within fifteen days following the date of publication of the Bulletin. Single reprints of any article published may be obtained from National headquarters, 18 East Division Street, Chicago, Ill., at a price of 10¢ each.

BUSINESS COMMUNICATIONS

All communications in regard to advertising, subscriptions, change of address, et cetera, should be addressed to the Chairman of the Publishing Committee, 2065 Adelbert Road, Cleveland, Ohio.

The Chairman of the Publishing Committee should be advised of change of address about fifteen days before the date of issue, with both old and new addresses given.

Because of the second class postal rates in effect the Postoffice does not forward the Bulletin unless extra postage is sent to the Postoffice to which the Bulletin was originally mailed.

Non-Receipt of Copies. — Complaints of non-receipt of copies should be made within ten days following date of publication, otherwise the supply is likely to be exhausted.